

PARTS LIST
OPERATING AND SERVICE MANUAL

GARDNER DENVER CycloBlower

TRUCK BLOWERS

T5CDL SERIES

37-2-600
Version 05
December, 2005

MAINTAIN BLOWER RELIABILITY AND PERFORMANCE WITH GENUINE GARDNER DENVER PARTS AND SUPPORT SERVICES

Factory genuine parts, manufactured to design tolerances, are developed for optimum dependability ---specifically for your blower. Design and material innovations are born from years of experience with hundreds of different blower applications. When you specify factory genuine parts you are assured of receiving parts that incorporate the most current design advancements . . . manufactured in our state-of-the-art blower factory under exacting quality standards.

Your AUTHORIZED DISTRIBUTOR offers all the backup you require. A worldwide network of authorized distributors provides the finest product support in the blower industry.

1. Trained parts technical representatives to assist you in selecting the correct replacement parts.
2. Complete inventory of new machines and new, genuine factory parts.
3. A full line of factory tested AEON™ PD blower lubricants specifically formulated for optimum performance in all blowers.
4. Authorized distributor service technicians are factory–trained and skilled in blower maintenance and repair. They are ready to respond and assist you by providing fast, expert maintenance and repair services.

For the location of your local authorized Gardner Denver blower distributor refer to the yellow pages of your phone directory, check the Web site at www.gardnerdenver.com or contact:

Gardner Denver Compressor Division
1800 Gardner Expressway
Quincy, IL 62305
Phone: (217) 222-5400
Fax: (217) 221-8780

INSTRUCTIONS FOR ORDERING REPAIR PARTS

For pricing, and ordering information contact your nearest AUTHORIZED FACTORY DISTRIBUTOR. When ordering parts, specify Blower MODEL and SERIAL NUMBER (see nameplate on unit).

Use this Parts List to select the parts you require. Where NOT specified, quantity of parts required per blower is one (1); where more than one is required per unit, quantity is indicated.

Specify EXACTLY the number of parts required.

Rely upon the knowledge and experience of your AUTHORIZED DISTRIBUTOR and let them assist you in making the proper parts selection for your blower.

FOREWORD

CycloBlower® blowers are the result of advanced engineering and skilled manufacturing. To be assured of receiving maximum service from this machine the owner must exercise care in its operation and maintenance. This book is written to give the operator and maintenance department essential information for day–to–day operation, maintenance and adjustment. Careful adherence to these instructions will result in economical operation and minimum downtime.

⚠ DANGER

Danger is used to indicate the presence of a hazard which will cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ WARNING

Warning is used to indicate the presence of a hazard which can cause severe personal injury, death, or substantial property damage if the warning is ignored.

⚠ CAUTION

Caution is used to indicate the presence of a hazard which will or can cause minor personal injury or property damage if the warning is ignored.

NOTICE

Notice is used to notify people of installation, operation or maintenance information which is important but not hazard-related.

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SAFETY PRECAUTIONS

Safety is everybody's business and is based on your use of good common sense. All situations or circumstances cannot always be predicted and covered by established rules. Therefore, use your past experience, watch out for safety hazards and be cautious. Some general safety precautions are given below:

⚠ DANGER

Failure to observe these notices could result in injury to or death of personnel.

- **Keep fingers and clothing away from revolving sheave, drive coupling, etc.**
- **Do not use the air discharge from this unit for breathing - not suitable for human consumption.**
- **Do not loosen or remove the oil filler plug, drain plugs, covers, or break any connections, etc., in the blower air or oil system until the unit is shut down and the air pressure has been relieved.**
- **Electrical shock can and may be fatal.**
- **Blower unit must be grounded in accordance with the National Electrical Code. A ground jumper equal to the size of the equipment ground conductor must be used to connect the blower motor base to the unit base.**
- **Open main disconnect switch, tag and lockout before working on the blower.**
- **Disconnect the blower unit from its power source, tag and lockout before working on the unit - the machine may be automatically controlled and may start at any time.**

⚠ WARNING

Failure to observe these notices could result in damage to equipment.

- **Stop the unit if any repairs or adjustments on or around the blower are required.**
- **Disconnect the blower unit from its power source, tag and lockout before working on the unit - the machine may be automatically controlled and may start at any time.**
- **Do not exceed the rated maximum speed shown on the nameplate.**
- **Do not operate unit if safety devices are not operating properly. Check periodically. Never bypass safety devices.**

INTRODUCTION
YOUR KEY TO TROUBLE FREE SERVICE

Although Gardner Denver blowers are sturdy, precision-engineered machines, there are several relatively simple but basic installation and maintenance procedures that must be observed to assure optimum performance. As there is no guesswork in the manufacture of these highly advanced units, there must be none in preparing them to get the job done in the field.

It is the purpose of this manual to help you properly install, maintain and service your Gardner Denver blower. It is important that no section be overlooked when preparing to install your blower.

Follow the instructions carefully and you will be rewarded with years of trouble-free operation.

SECTION 1
EQUIPMENT CHECK

Before uncrating, check the packing slip carefully to be sure all the parts have been received. All accessories are listed as separate items on the packing slip, and small important accessories such as relief valves can be overlooked or lost. After every item on the packing slip has been checked off, uncrate carefully. Register a claim with the carrier for lost or damaged equipment.

⚠ WARNING

Customers are cautioned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards involved in installation and operation of this equipment in the system or facility.

STORAGE

Your Gardner Denver Blower was packaged at the factory with adequate protection to permit normal storage for up to six (6) months.

If the unit is to be stored under adverse conditions or for extended periods of time, the following additional measures should be taken to prevent damage.

1. Store the blower in a clean, dry, heated (if possible) area.
2. Make certain inlet and discharge air ports are tightly covered to prevent foreign material from entering the air box.
3. All exposed, non-painted surfaces should be protected against rust and corrosion.
4. Provide adequate protection to avoid accidental mechanical damage.
5. In high humidity or corrosive environments, additional measures may be required to prevent rusting of the blower internal surfaces.
6. To prevent rusting of gears, bearings, etc., the oil reservoirs may be filled with normal operating oil.

⚠ CAUTION

Before running the blower, drain the oil and replace to the proper operating level with clean, fresh lubricant.

7. Rotate the blower shaft (10 to 25 turns) monthly during storage. Inspect the blower shaft (near the shaft seal area) monthly and spray with rust inhibitor if needed.
8. For long term storage (over six (6) months), contact Gardner Denver Compressor Division Customer Service for recommendations.

SECTION 2
INSTALLATION

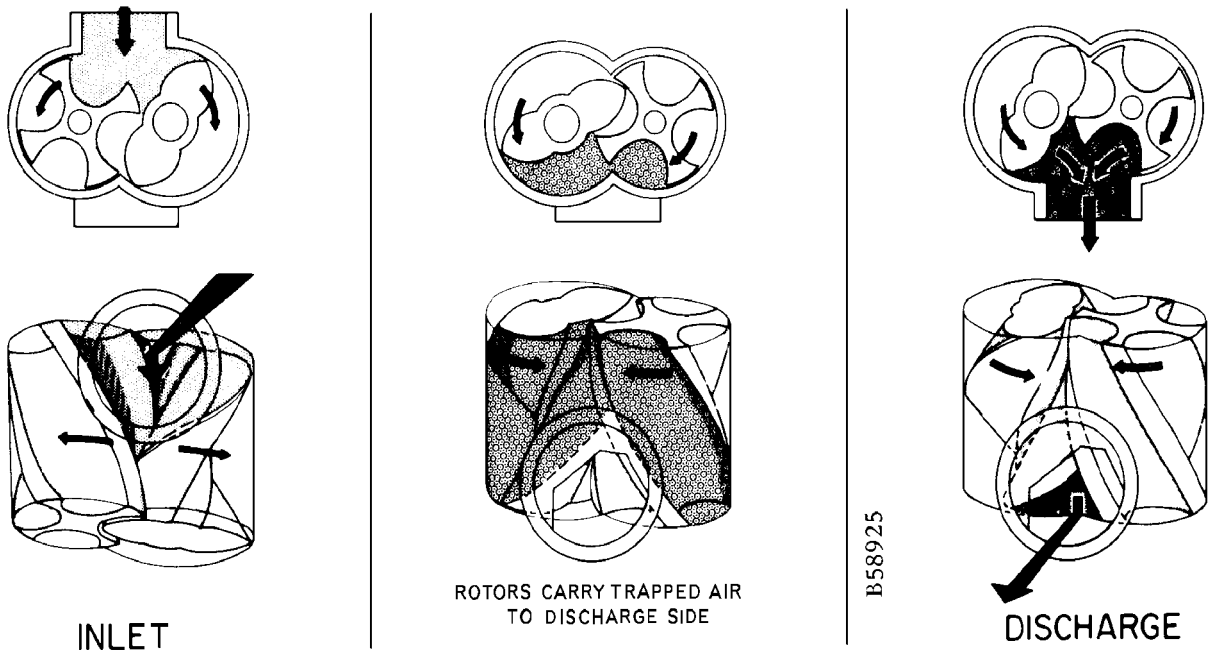


FIGURE 1 - OPERATING PRINCIPLE

GENERAL - The CycloBlower® is a compact, rotary lobe type axial flow blower. The meshing of two screw type rotors synchronized by timing gears provides controlled compression of the air for maximum efficiency and pulsation-free discharge.

OPERATING PRINCIPLE - Compression is effected by the main (2 lobe) and gate (4 flute) rotors meshing enclosed in the housing. The timing gears maintain close rotor clearances. The rotors do not touch each other, the housing, or the bearing carriers. Although clearances are small, lubrication in the compression chamber is not required, insuring oil-free air delivery.

The compression cycle (FIGURE 1) begins as the rotors unmesh at the inlet port. Air is drawn into the rotor cavities, trapped, and compressed by the reducing cavities as rotation continues. When proper compression is made, the cavities cross the discharge port, completing the cycle. The cycle occurs twice each revolution and is continuous.

T5CDL9L, T5CDL12L & T5CDL13L CycloBlower® TRACTOR MOUNTED, POWER TAKE-OFF DRIVE

DESCRIPTION - The T5CDL9L, T5CDL12L & T5CDL13L units are designed for bracket mounting on a truck tractor and driven by a power take-off (FIGURE 2, page 3). Bottom inlet, top discharge is standard. The blower is driven by the gate rotor shaft. The blower may be driven from either end to get proper blower rotation in relation to power take-off rotation. Standard blower rotation, unless otherwise specified, is counterclockwise viewing the drive shaft at the gear end (FIGURE 5, Page 6).

INSTALLATION OF T5CDL9L, T5CDL12L & T5CDL13L CYCLOBLOWER (POWER TAKE-OFF UNIT) - There are four common blower mounting positions:

Roadside Mounting with	1)	CCW Rotation
	2)	CW Rotation
Curbside Mounting with	3)	CCW Rotation
	4)	CW Rotation

To change drive end for optional rotation:

For T5CDL9L, T5CDL12L and T5CDL13L change the shaft cover only to the opposite end.

A universal mounting bracket is available for these positions -- changes may be necessary to fit a specific application. Exact installation instructions cannot be given because of the variety of tractors and PTO models available. Always observe the following fundamentals for any blower mounting.

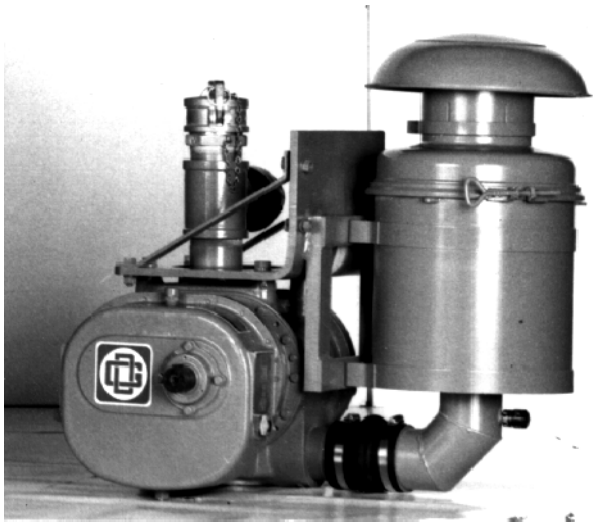


FIGURE 2 - MODEL T5CDL9L CYCLOBLOWER



FIGURE 3 - MODEL T5CDL12L9 CYCLOBLOWER

⚠ WARNING

Rotating components will cause severe injury in case of personal contact. Keep hands away from the blower inlet and discharge ports.

1. Check output speed range of the PTO. It must be suitable for the blower range (FIGURE 6, Page 7).
2. The blower should be parallel to the truck frame to minimize vibration.
3. The PTO shaft must be within the manufacturer's angularity limits.
4. Brace mounting securely to reduce vibration.
5. Be sure the air filter, oil level gauge, gear case breather and suction end bearing covers are not obstructed for normal maintenance.

⚠ WARNING

Do not electric weld on the blower or base; bearings can be damaged by the passage of current.

T5CDL12L9 & T5CDL13L9 CycloBlower® TRAILER MOUNTED, ENGINE DRIVEN

DESCRIPTION – The T5CDL12L9 and T5CDL13L9 units are designed for base mounting on a trailer (FIGURE 3). The blower is mounted on the engine flywheel housing and direct connected to the flywheel (FIGURE 4, page 4). The blower is driven by the main rotor shaft. Top inlet and bottom discharge is standard. Blower rotation is clockwise viewing the drive shaft.

INSTALLATION OF T5CDL12L9 & T5CDL13L9 CYCLOBLOWER (ENGINE DRIVEN UNIT) – The blower is supplied either as a complete engine–blower unit, or as a bare blower. A variety of components and accessories may also be supplied.

Installing A Complete Unit:

1. Mount the unit so that all controls are accessible to the operator.
2. Use rubber pad type vibration dampers under the steel base to prevent damage to components of the engine and blower.
3. Bolt the unit down securely, but do not distort the coupling alignment or blower housing.
4. Direct engine exhaust away from blower air filter.
5. Be sure air filter, oil level gauge and gear case breather are not obstructed for normal maintenance.

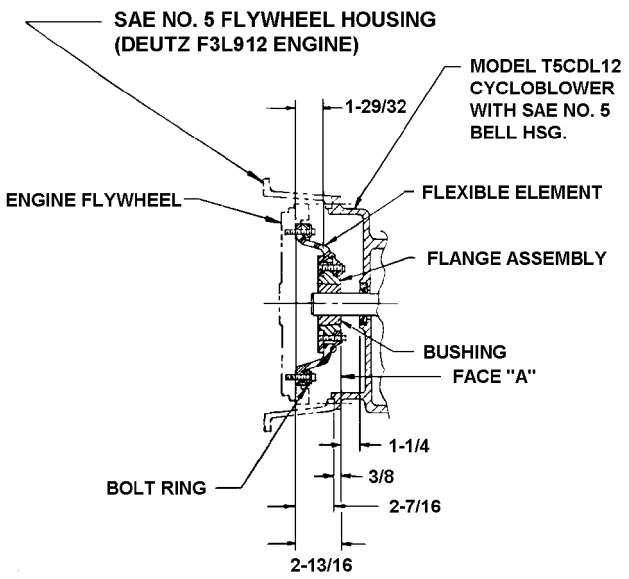


FIGURE 4 - T5CDL12L9 - DEUTZ F3L912 COUPLING INSTALLATION

⚠ WARNING

Do not electric weld on the blower or base; bearings can be damaged by the passage of current.

Installing a Bare T5CDL12L9 Blower to Deutz F3L912 Engine:

NOTICE

Installation instructions are for Deutz F3L912 engine only. For installation instructions for use with other engines and couplings, contact the nearest Gardner Denver Office.

1. Provide a rigid, level base and use rubber pad type vibration dampers between the base and trailer frame.
2. Bolt the engine to the engine/blower base with controls and instruments accessible to the operator.
3. Assemble the coupling flange, flexible element and clamp ring (FIGURE 4). With the bead of the element properly seated in the flange, tighten the clamp ring screws alternately and evenly until metal–to–metal contact is obtained between the clamp ring and flange. This in necessary to prevent slippage of the coupling.
4. Install the taper lock bushing in the coupling flange, being sure to line up the screw holes. Hang the bolt ring on the flexible element and slide the coupling assembly over the blower shaft and key. Draw up the taper lock bushing Allen screws just tight enough to allow the coupling assembly to slide on the blower shaft.
5. Slide the coupling on the shaft until the distance from the connecting face of the blower bell housing to the flat surface “A” (FIGURE 4, page 4) on the back side of the coupling flange is 1–3/16”. Check clearance between the coupling hub and drive shaft seal housing which should be 7/16”. Check the entire circumference since the face of the seal housing is a rough surface. Tighten the taper lock hub screws evenly to assure the coupling is square with the shaft. Recheck the 1–3/16” dimension and 7/16” clearance. Since the measurement from the face of the engine flywheel coupling to the adaptor ring is 1–5/8”, the positioning of the hub assembly as decribed above will give the 1–29/32” dimension called for in the Dodge coupling instructions.
6. Mount the blower to the engine flywheel housing with seven (7) 10 mm x 25 mm lg. hex head cap screws and lock washers. Rest the feet of the blower on the base supports. With the pilot on the blower housing just entered into the engine housing, pull up one cap screw on each side of the housing evenly until the faces of the housings just touch at the top and bottom. If a gap occurs between housing faces at the top, shim under the blower feet until the housing pulls up evenly at the top and bottom. If the gap is at the bottom, shim under the engine feet until the housing pulls up evenly. When alignment of the faces is correct, install and tighten all blower housing screws securely.
7. Couple PF96 coupling to the engine flywheel using six (6) 10 mm x 40 mm lg. socket head cap screws and lock washers supplied with the coupling.
8. Fill the blower drive end reservoir with oil. The sight glass should be half covered with oil. See “Lubrication,” page 13.
9. Check the engine in accordance with the manufacturer’s instruction manual.

10. Run the bower slowly and check for secure mounting or excessive vibration.

PIPING FOR T5CDL9, T5CDL12 & T5CDL13 – Refer to the trailer manufacturer's instructions manual for piping details. For safe and efficient blower operation observe the following:

1. Install an adequate air filter on the blower inlet. Refer to "Air Filter", page 13, for air filter specifications.
2. Insure that inlet and discharge piping are clear, clean and air tight. Do not allow dirt to enter the blower during piping operations.
3. For pressure service, install an air relief valve in discharge line as close to the blower as possible.

   For vacuum service, install the vacuum relief valve in the alternate inlet port of the blower.

⚠ CAUTION

Do not use caps, covers, or valves between the blower and relief valve.

4. Install a check valve in the discharge line after the relief valve to prevent back flow of material into the blower.
5. Provide a discharge bypass valve to the atmosphere for air bleedoff.

NOTICE

Relief valves should be placed as close as possible to the blower inlet port (vacuum operation) or blower discharge port (pressure operation).

6. Install an accurate pressure gauge at or near the blower discharge for pressure operation.

   Install an accurate vacuum gauge at or near the blower inlet port for vacuum operation.
7. Provide an adequate sized discharge line. Use as few bends as possible; when bends are necessary, use long radius bends.
8. Make provision in the piping to allow for expansion as near to the blower as possible.
9. Use a dust cover at the final discharge opening when the hose is removed.
10. If the blower is enclosed for weather protection, the air filter must be installed outside the enclosure.

OPERATING LIMITS (PRESSURE)

⚠ WARNING

Operating beyond the specified operating limitations will result in damage to the unit.

The term "intermittent operation" is defined as operation for no longer than 10 seconds at maximum pressure provided that the inlet restriction (filter pressure drop, etc.) does not exceed 20" (508 mm) of water.

This time interval will be enough time for the blower to unplug a line or a hose.

When the blower pressure is at maximum pressure for over 10 seconds, stop the blower and remove the line blockage manually. Otherwise the blower might seize due to excessive operating temperature and pressure.

⚠ WARNING

Never operate blower above 20 PSIG (1.38 bar) pressure on gauge at immediate blower discharge.

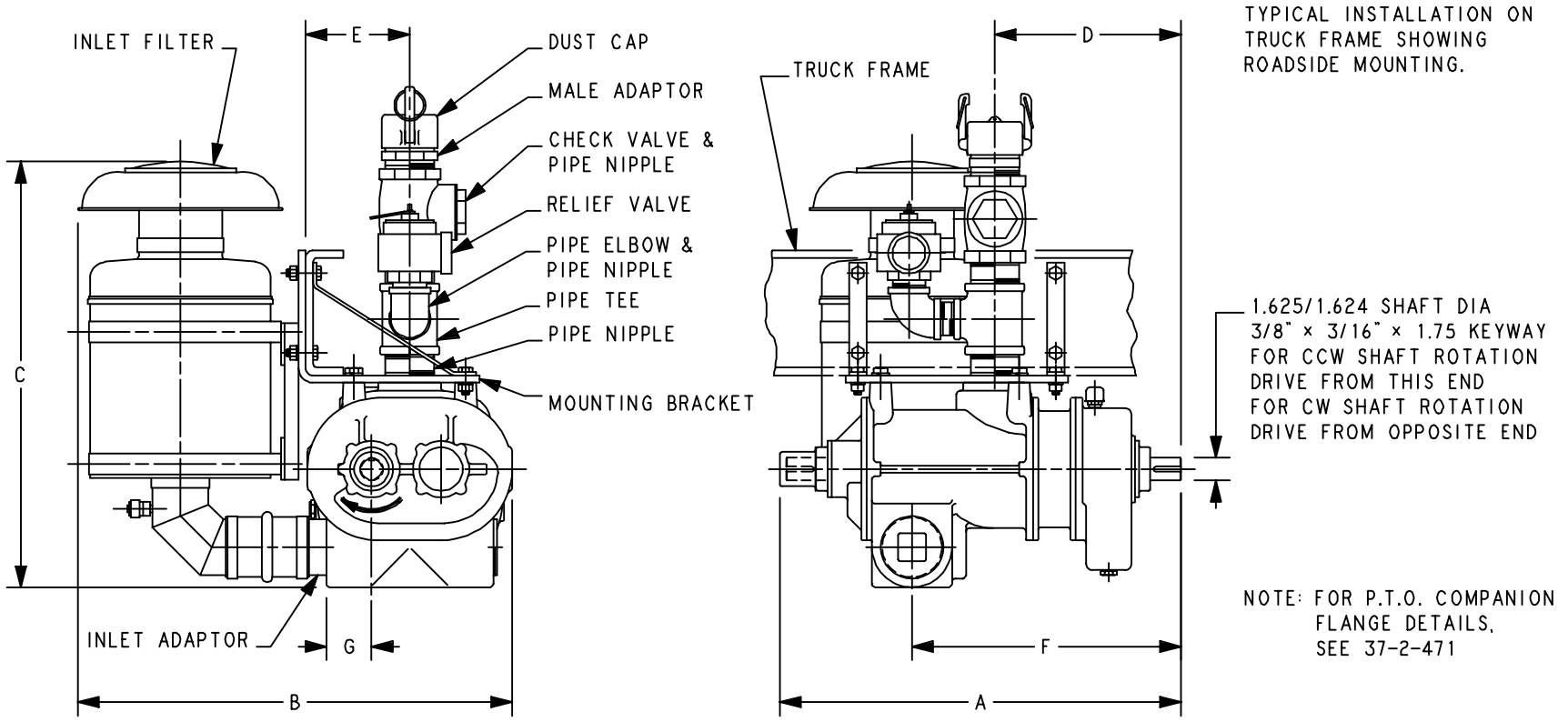
See page 7, for maximum pressure limits when operating below maximum speed or above sea level.

V-BELT DRIVES – The standard T5CDL series truck blowers are designed for simple v-belt drives with belt pull up to 500 lbs. on the grease end and up to 375 lbs. on the oil end. Align the sheaves and tension the belts per v-belt manufacturer's instructions.

⚠ WARNING

Overtightened belts leads to heavy bearing/shaft loads and premature failure.

Contact Gardner Denver for availability of optional blowers to use on simple v-belt applications whose belt pull exceeds the stated limits.



BLOWER MODEL	A	B	C	D	E	F	G
T5CDL9 (BARE DWG. NO. 37-2-400)	25.9 (658)	31.3 (795)	30 (762)	13.4 (340)	7.5 (191)	16.9 (429)	3 (76)
T5CDL12 (BARE DWG. NO. 37-2-420)	28.9 (734)	31.3 (795)	30.6 (777)	13.4 (340)	7.5 (191)	19.4 (493)	3.3 (84)
T5CDL13 (BARE DWG. NO. 37-2-440)	28.9 (734)	31.3 (795)	30.6 (777)	14.1 (358)	7.5 (191)	19.3 (490)	3.3 (84)

CYCLOBLOWER MODELS
T5CDL9 - T5CDL12 - T5CDL13
GATE ROTOR DRIVE - TRUCK MOUNTED
FOR P.T.O. DRIVE-TOP DISCHARGE

FIGURE 5 - OUTLINE - TRACTOR MOUNTED POWER TAKE-OFF APPLICATION, ROADSIDE MOUNTING

SECTION 3
OPERATION

Future operating problems can be avoided if proper precautions are observed when the equipment is first put into service. Before starting under power, the blower should be turned over by hand to make certain there is no binding, or internal contact.

Each size blower has limits on pressure differential, running speed, and discharge temperature which must not be exceeded. These limits are shown in the following tabulation.

Relief valves should be used to protect against excessive pressure or vacuum conditions. These valves should be tested at initial startup to be sure they are adjusted to relieve at or below the maximum pressure differential rating of the blower.

GENERAL – This section covers the operation of the CycloBlower unit only. Before attempting to operate the tank trailer, study the manufacturer's instruction manual. A new blower from the factory must be checked and serviced before operation. The blower must be lubricated and operated according to the following instructions. Blower failure can be caused by operation above the rated pressure, or below the rated speed. Both cause excessive discharge temperature and seizing of rotating parts. The tachometer must be calibrated to indicate accurate blower speed.

SPEED OF BLOWER – Maximum allowable speed for T5CDL9L, T5CDL12L & T5CDL13L is 2000 RPM; for T5CDL12L9 & T5CDL13L9, 4000 RPM. There is a definite relationship between blower speed, discharge pressure and the resulting discharge air temperature. The blower may be damaged by overheating if operated below minimum speeds and above maximum pressures shown below.

T5CDL9, T5CDL12 & T5CDL13 PTO Gate Rotor Drive		T5CDL12 & T5CDL13 Main Rotor Drive	
Minimum Speed RPM	Maximum Pressure PSIG (bar)*	Minimum Speed RPM	Maximum Pressure PSIG (bar)*
900	12 (0.83)	1400	12 (0.83)
1000	14 (0.97)	1600	14 (0.97)
1100	16 (1.10)	1800	16 (1.10)
1200	18 (1.24)	2000	18 (1.24)
1300	20 (1.38)	2200	20 (1.38)

* Maximum allowable discharge pressure at sea level is 20 PSIG (1.38 bar) for "INTERMITTENT OPERATION ONLY". Maximum pressure allowable decreases with increase in altitude; hence trailer unloading time will be longer.

FIGURE 6 - SPEED/PRESSURE CHART

Altitude Ft. (Meters)	Maximum Intermittent Pressure** PSIG (Bar)
1000 (305)	19.0 (1.31)
2000 (610)	18.5 (1.28)
3000 (914)	18.0 (1.24)
4000 (1219)	17.5 (1.21)
5000 (1524)	17.0 (1.17)

Above 4922 Ft. (1500 m) - Consult nearest Gardner Denver Office.

** Maximum pressure is gauged at blower discharge and is for "INTERMITTENT OPERATION ONLY AT MAXIMUM SPEED". Reduce above pressure 1 PSIG (.069 bar) for line loss when reading trailer air discharge gauge.

FIGURE 7 - ALTITUDE/PRESSURE CHART

⚠ WARNING

Gardner Denver blowers are shipped dry from the factory. Do not attempt to operate the blower before following proper lubrication instructions. Permanent damage to the gears, bearings and seals will occur.

PRESTARTING CHECK

For a New or Overhauled Blower:

1. Blower rotation as indicated.
2. Correct alignment of shafts.
3. Blower turns freely.
4. Air filter and fittings are tight.
5. Air filter is serviced.
6. All bolts are tight.
7. Proper oil level in gear case. (See Maintenance, Section 4, page 12.)
8. Check valve okay.
9. Relief valve okay.
10. Fusible plug okay.

11. Engine is serviced (T5CDL12L9 & T5CDL13L9). Refer to engine manual.

Daily Check:

1. Air filter is tight, clean and serviced if necessary.
2. Proper oil level in the gear case. (See Maintenance, Section 4, page 12.)
3. Blower turns freely.
4. Engine is serviced (T5CDL12L9 & T5CDL13L9). Refer to engine manual.

STARTING THE T5CDL9L, T5CDL12L AND T5CDL13L CYCLOBLOWER (POWER TAKE-OFF DRIVEN)

1. Open the trailer bypass valve to atmosphere to start the blower under no-load.
2. Idle the truck engine at low idle
3. Slowly engage the power take-off.

⚠ WARNING

It is important NOT to pop the clutch on engagement.

4. Slowly increase the blower speed until the operating range is reached (blower at zero pressure). In cold weather, warm up the blower at reduced speed and zero pressure.
5. Check for severe vibration, unusual noise, leaks, and undue heating.

⚠ WARNING

Do not operate blower which is noisy, vibrating, or heating excessively.

6. With the blower at operating speed, follow the trailer manufacturer's instructions to apply pressure to the system.
7. Check speed and pressure during pressure build-up. The blower will heat as pressure builds, but will level off in a short time.

STARTING THE T5CDL9L7, T5CDL12L9 & T5CDL13L9 CYCLOBLOWER (ENGINE DRIVEN)

1. Open the trailer bypass valve to atmosphere to start the blower under no-load.
2. Start the engine according to the manufacturer's manual.
3. Idle the engine to warm up (blower at zero pressure).
4. Slowly increase the blower speed until the operating range is reached (blower at zero pressure).
5. Check for severe vibration, unusual noise, leaks, and undue heating.

⚠ WARNING

Do not operate blower which is noisy, vibrating, or heating excessively.

6. With the blower at operating speed, follow the trailer manufacturer's instructions to apply pressure to the system.
7. Check speed and pressure during pressure build-up. The blower will heat as pressure builds, but will level off in a short time.

PRESSURE

⚠ WARNING

Never operate the blower above 20 PSIG (1.38 bar) pressure on the gauge at immediate blower discharge.

Maximum relief valve setting at sea level is 20 PSIG, (1.38 bar) . Higher pressure causes excessive heating and blower failure. Allowing one PSI (.069 bar) pressure drop from blower to product discharge line, pressure should not exceed 19 PSIG (1.31 bar) at trailer gauge. Open the bypass valve to atmosphere if necessary to hold this pressure; do not reduce blower speed below minimum shown in Speed/Pressure Chart (FIGURE 6, Page 7). Gauges must be calibrated to indicate pressure accurately.

HEATING - All blowers are factory equipped with fusible plugs in the discharge passage of the housing. When a safe discharge temperature has been exceeded, the core of this plug will melt out signalling

excessive temperature. The blower should be stopped and the cause of heating corrected.

⚠ WARNING

Do not continue to run blower which is overheating. Do not restart blower which has overheated until the cause of overheating has been corrected, and blower checked for damage.

If it is necessary to replace the fusible plug, replace with Gardner Denver Part Number 8501246 ONLY.

SHUTDOWN

1. Open the line valve and/or the bypass valve.
2. Close the product discharge valves.
3. Bleed the tank pressure to zero.
4. Idle the engine.
5. Allow the unit to cool down at idle for several minutes (blower at zero pressure).
6. Disengage the power take-off (T5CDL9L, T5CDL12L & T5CDL13L).
7. Stop the engine (T5CDL12L9 & T5CDL13L9).

Never stop the blower with pressure in the material tank. Blowback may force material into the blower if the check valve is inoperative.

EMERGENCY SHUTDOWN – In the event of power failure, and the blower stops with pressure on the system:

1. Relieve the pressure on the materials tank and line.
2. Determine and correct the cause of the stoppage.
3. Inspect the inside of the blower for product back-flow.
4. If the blower is clear, restart using the standard procedure.

RELIEF VALVE – The relief valve is important for blower protection. It must always function correctly at set pressure. In emergencies, if the relief valve fails, open the bypass valve line to the atmosphere to control blower pressure.

⚠ CAUTION

Never operate the blower with a defective relief valve.

BLOWER STARTUP CHECKLIST

This startup procedure should be followed during the initial installation and after any shutdown periods or after the blower has been worked on or moved to a new location. It is suggested that the steps be followed in sequence and checked off (✓) in the boxes provided.

☐ 1. Check the unit and all piping for foreign material and clean if required.

☐ 2. Check the flatness of the feet and the alignment of the drive. Feet that are bolted down in a bind can cause housing distortion and internal rubbing. Misaligned V-drives can cause the rotors to rub against the headplates and cause a reduction in the volumetric efficiency of the unit. Misaligned couplings can ruin bearings.

☐ 3. If the blower is V-belt driven, check the belt tension and alignment. Over-tensioned belts create heavy bearing/shaft loads which lead to premature failure.

☐ 4. Be sure adequate drive guards are in place to protect the operator from severe personal injury from incidental contact.

☐ 5. Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Too little oil will ruin bearings and gears. Too much oil will cause overheating and can ruin gears and cause other damage. Insure that grease lubricated bearings are properly lubricated.

☐ 6. Turn the drive shaft by hand to be certain the rotors do not bind.

☐ 7. “Jog” the unit with the motor a few times to check that rotation is in the proper direction, and to be certain it turns freely and smoothly.

☐ 8. Start the unit and operate 15 minutes at no load. During this time, check for hot spots and other indications of interference.

☐ 9. Apply the load and observe the operation of the unit for one hour. Check frequently during the first day of operation.

☐ 10. If malfunctions occur, do not continue to operate. Problems such as knocking rotors can cause serious damage if the unit is operated without correction.

TROUBLESHOOTING TRUCK BLOWER PROBLEMS

Blower failure can be caused by the following:

1. Operation at higher than maximum rated pressure.
2. Operation at below minimum allowable speed.
3. Insufficient lubrication.
4. Product carry-over into the blower.

Some specific items to check when blower problems occur are:

1. Pressure related problems:
   - A) Determine the maximum allowable discharge pressure for the altitude involved. See Altitude/Pressure Chart (FIGURE 7, Page 7).
   - B) Check the actual blower discharge pressure as close to the blower discharge port as possible with an accurate gauge.
   - C) Check the inlet filter for excessive pressure loss due to restricted or plugged filter element.
   - D) Check the line pressure relief valve for proper operation at no more than maximum allowable pressure.
2. Speed related problems:
   - A) Determine the actual blower speed. On PTO Models, a hand tachometer can be used opposite the drive end.
   - B) For minimum allowable blower speed for pressure being produced, see Speed/Pressure Chart (FIGURE 6, Page 7).
3. Insufficient lubrication:
   - A) Check the oil sump for proper oil grade and viscosity at the existing ambient temperature. Check the proper oil level. Level should be maintained at the middle of the sight gauge while at idle on a level surface.
   - B) When the truck is parked on an incline to unload, be certain that the large gear will pick up oil during the operation.
   - C) Check grease lubricated bearings for the proper type and amount of bearing grease.
   - D) See Lubrication, Section 4, Page 12, for details.
4. Nonrotatable blower:
   - A) Remove the inlet filter. Check the interior of the blower for possible backflow of the product being conveyed. If the product is present, the trailer check valve is probably faulty and should be repaired or replaced.
   - B) Check the interior for possible rust contamination. Check for possible rotor contact due to loss of clearances caused by excessive temperature, related to overpressure or low speed operation.

SECTION 4
MAINTENANCE

GENERAL – Blower efficiency and life depend on the quality of maintenance the blower receives. Maintenance must be done regularly and with care. A clean work space, tools, solvents, and wiping rags are necessary to avoid transferring dirt into the unit. A maintenance chart listing each blower and scheduling regular checks of the unit is valuable. A good program, well carried out, will insure long trouble–free service from the CycloBlower®.

RECOMMENDED LUBRICANT – AEON PD Synthetic Blower Lubricant is recommended. Refer to Recommended Lubricant Chart (FIGURE 8) for AEON PD temperature recommendations.

If not using AEON PD synthetic blower lubricant, use turbine quality oils with rust and oxidation inhibitors, anti–foam additives and the viscosities listed in the Viscosity Requirements Chart (FIGURE 9).

Check the oil level of the blower daily. The oil change period is governed by operating conditions, such as load, temperature, dirt, humidity, fumes and quality of oil used. Under severe operating conditions the oil should be changed every 100 hours or more often. Under ideal operating conditions oil may be used up to 1000 hours. Use of AEON PD could extend the change interval up to 8000 hours based on a good oil analysis program. Change the oil often enough that it appears clean and clear when drained from the sump.

Blower Discharge Temperature		Factory Tested Recommended and Approved Lubricant
° F	° C	
32° 100° 275° 350°	0° 38° 135° 177°	AEON PD Synthetic Blower Lubricant One Superior Lubricant For All Operating Temperatures

AEON PD	1 Qt. (1.057 L) Bottle	Part No. 28G23
AEON PD	12 Qt. (11.35 L) Case	Part No. 28G24
AEON PD	5 Gal. (18.93 L) Pail	Part No. 28G25
AEON PD	55 Gal. (208.18 L) Drum	Part No. 28G28

FIGURE 8 - RECOMMENDED LUBRICANT

Blower Discharge Temperature	Oil Grade ISO	Oil Viscosity SUS @ 100° F (CST @ 40° C)
32° F to 100° F (0° C to 38° C)	100	465 (100)
100° F to 225° F (38° C to 105° C)	150	700 (150)
225° F to 300° F (105° C to 149° C)	220	1000 (220)
Over 300° F (149° C)	*	*

* The oil viscosity must be 70 SUS (13 Centistokes) minimum at blower discharge temperature less 50° F (28° C).

NOTES:

1. Napthenic base lubricants are not recommended.
2. For operation at ambient temperatures below 10° F. (–12° C), the use of oil sump heaters or synthetic lubricants is recommended. The pour point of the lubricant should be at least 5° to 10° F. (3° to 6° C) below the minimum expected ambient temperature.
3. For continuous operation where oil sump temperatures exceed 200° F. (93° C), use AEON PD Synthetic Blower Lubricant.

FIGURE 9 - VISCOSITY REQUIREMENTS

AEON PD is formulated especially for positive displacement blower service to provide maximum blower protection at any temperature. One filling of AEON PD will last a minimum of 4 times longer than a premium mineral oil, depending on actual operating conditions. Order AEON PD from your Gardner Denver distributor.

LUBRICATION

Discharge End (Gear End) – Gears and gear end bearings are oil splash lubricated. Filling the gear case with the amount of oil shown will bring the oil level to about half covering the sight glass. Add more oil if necessary to bring the level to half of the sight glass. Do not overfill. Keep the sight glass clean. Oil is added through the breather filter hole on top of the gear end cover.

T5CDL9L, T5CDL12L & T5CDL13L ..... 2-1/4 qts.
T5CDL12L9 & T5CDL13L9 ..... 2 qts.

⚠ CAUTION

Do not operate the blower unless oil shows in the sight glass.

Check gear case oil level daily. Change oil every 100 hours of operation or more often if dust and moisture conditions are severe. Gear case should be flushed with clean solvent every four oil changes.

NOTICE

Always use clean containers for oil.

Inlet End – Inlet end bearings are grease lubricated at the factory with a Lithium Complex or Lithium-12 hydroxy based grease. For relubrication, select a compatible base grease. Regrease bearings every 250 hours of operation. Use a good grade of grease NLGI Grade No. 1 or 2 suitable for operating temperatures to 300° F. (150° C).

A grease fitting is located in the bearing carrier for each bearing and a pressure relief fitting is located on each bearing cover. These fittings should be cleaned of all dirt and foreign material before lubricating bearings. With a pressure or hand gun fill the bearing cavity with grease until it begins to come out of the grease relief fitting.

AIR FILTER

⚠ WARNING

Servicing the air filters is one of the most important maintenance operations to be performed to insure long blower life.

Servicing frequency of filter elements is not time predictable and must be established by the user, depending on dust and moisture conditions.

NOTICE

No matter what type of filter is used, always make sure all seats, gaskets, clamps and hose connections on the filter and inlet line are absolutely air tight. Each time the filter is serviced, inspect the interior of the blower for dirt.

Dry Type Filter – Servicing must be done on a regular basis according to the manufacturer's instructions. To service a dry type air filter used on tractor mounted PTO applications:

1. Remove the cover and element.
2. Discard the element (estimated life: 50 to 300 hours).
3. Wash or wipe out the cover, filter body, seals, and blower suction opening.
4. Install the new element.
5. Install the new gasket washer (.62", 9.76 mm diameter hole) with the metal side to face the wing nut. Tighten the wing nut to secure the element.
6. Replace the cover and top cap.
7. Make sure all connections to the air filter are air tight.

Dry type filter elements should not be reused. Blowing out may puncture the element and make it useless. In an emergency, loose dirt may be removed by tapping the end of the element on a smooth flat surface. Use care not to damage the end or get dirt on the clean air side. Do not allow grease, oils, or solvents to contact the element.

⚠ CAUTION

Never operate the blower if the air filter has damaged seals or element.

GEAR CASE BREATHER – At each gear case oil change, remove, clean and the breather. If damaged, replace with a new breather.

ROTOR SHAFT SEAL – Rotors have a labyrinth type shaft air seal to minimize air leakage along the shaft from the compression chamber. More air will leak through the seals at the discharge end since they are under higher air pressure. Air leakage is vented to atmosphere through vent holes from the area between the shaft seal and the bearing oil (or grease) seal. Excessive air leakage indicates shaft seal failure.

The air seal consists of two parts, a steel bearing spacer with grooves (labyrinth) cut into the outside diameter fitted on the rotor shaft, and a steel ring lined with bronze–filled Teflon* (shaft seal) pressed into the bearing carrier. The grooved end of the spacer and the shaft seal bore have a close fit when cold. When the blower reaches operating temperature a close running fit is obtained between the tops of the labyrinth and the ring to control air leakage along the shaft. No maintenance is required, except replacement if the seal fails. For seal replacement, refer to Disassembly, Section 6, page 27 and Assembly, Section 7, page 30.

BEARING OIL SEALS – Oil or grease leakage is prevented by a lip type seal pressed into the bearing carrier. Usual causes of seal failure are: high temperature, rough surface on the bearing spacer, damage during installation, or improper seal used. The radius at the end of the bearing spacer and the O.D. should be highly polished to prevent seal lip damage during installation. Use only seals shown in the parts list as they have been selected for blower service.

BEARING CARRIER VENT HOLES – There are two vent holes fitted with a breather in each bearing carrier. Each hole connects the space between the shaft air seal and the lip–type bearing oil seal with the atmosphere. The vent bleeds the controlled leakage of air from the shaft air seal to the atmosphere. More air will bleed through the gear end holes since the gear (discharge) end is at a higher pressure than the inlet end. Inspect vent holes and vent breathers for obstruction by foreign material. Plugged vents may cause pressurization of oil sump and blow oil out through the oil sump breather–filter.

Oil blowing out of the vents indicates a bearing seal failure. A slight oil wetting of the vents is not considered a seal failure.

ACCESSORIES – Although the relief valve, check valve, pressure gauges, and tachometer are usually furnished by others, their function is vital to the life of the blower. See trailer instruction manual for details.

Pressure Gauges must be kept calibrated to get accurate readings of blower pressure.

Tachometer must be kept accurate to insure proper speed of the blower. Underspeed can destroy a blower.

Check Valve is to prevent backflow of material into the blower. If it fails to function, the blower is subject to failure.

Relief Valve protects the blower against overpressure. If it fails to function regularly and accurately, the blower can fail quickly.

STORAGE – For internal protection during extended shutdown or storage periods apply a light coat of rust inhibitor oil to all surfaces in the rotor chamber, and gears, bearings and bearing spacers.

* Registered trademark of DuPont.

OVERHAUL KIT - 8507529

Description	Qty.	Part Number
SEAL-ROTOR SHAFT	4	8501081
SHIM-HOUSING	1	8500023
SHIM-HOUSING SET	1	8500029
SHIM-SHAFT SET	1	8500260
SHIM-SHAFT SET	1	8501269
GASKET-COVER	1	8500030
GASKET-COVER	3	8500163
SEAL-OIL	2	8501240
SEAL-OIL	4	60DD513
BEARING-BALL	1	8500165
BEARING-CYLINDRICAL ROLLER	1	8501200
BEARING-ANGULAR CONTACT	4	8500406
WASHER-PLAIN	5	95W48
LOCKNUT, BEARING	3	50Z9
LOCKWASHER, BEARING	3	95W25
PLUG-FUSIBLE	1	8501246
SPACER-BEARING	4	8500148
CAPSCREW	8	75P6N
CAPSCREW	8	75P57N
WASHER-PLAIN	4	95U3

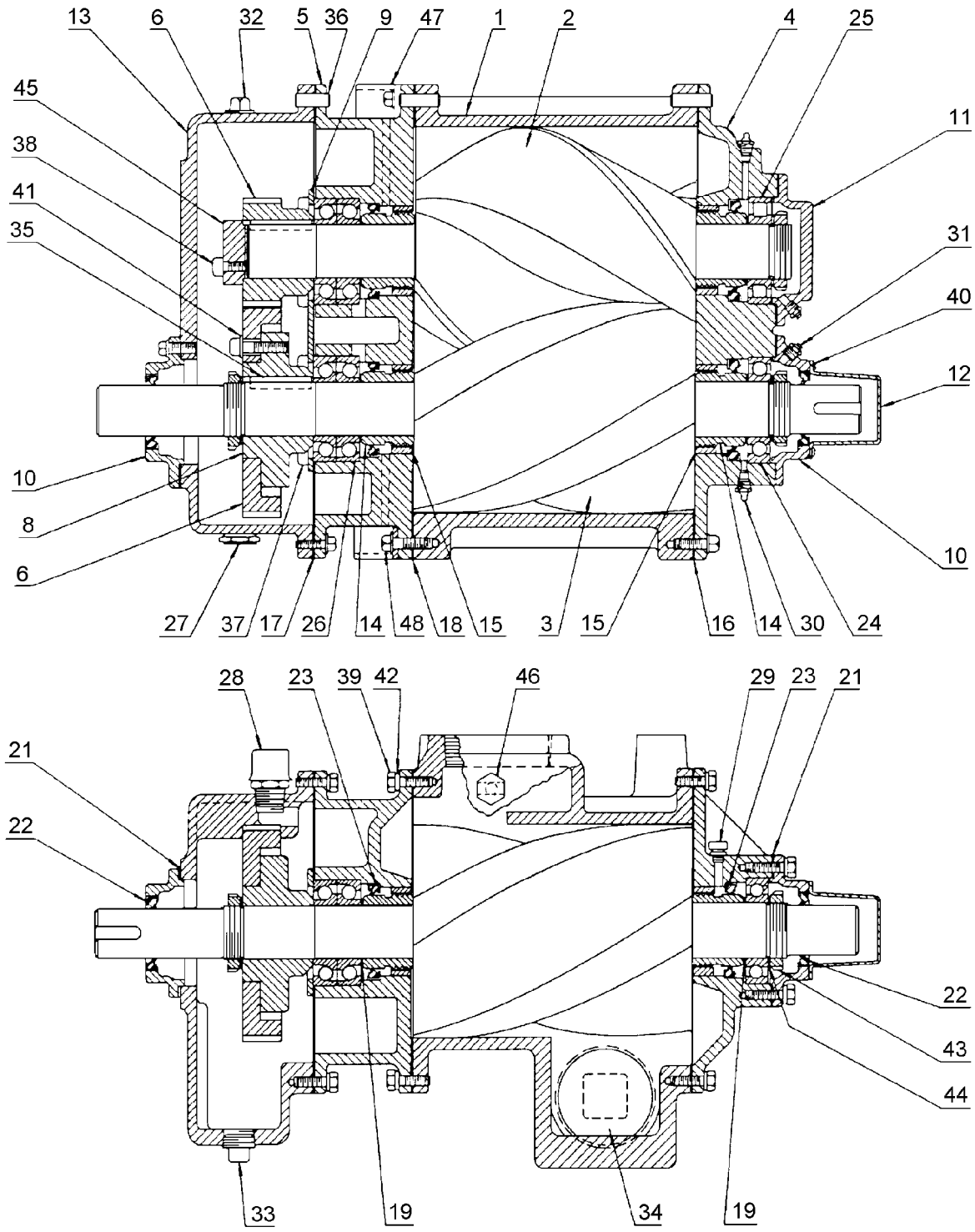
IMPORTANT: For spare parts requirement in remote areas, export or where more than one unit is operating, a spare gear set is recommended.

For Models T5CDL9L, T5CDL9L7, T5CDL12L9 & T5CDL13L9 order kit part number 200CTH6008 which consists of one gear and one pinion.

For Models T5CDL12L, T5CDL13L & T5CDL13L7 order kit part number 201CTH6008 which consists of one gear and one pinion.

NOTE: Overhaul kit is recommended for spare parts and/or scheduled maintenance or overhaul requirements.

FIGURE 10 - OVERHAUL KIT - 8507529



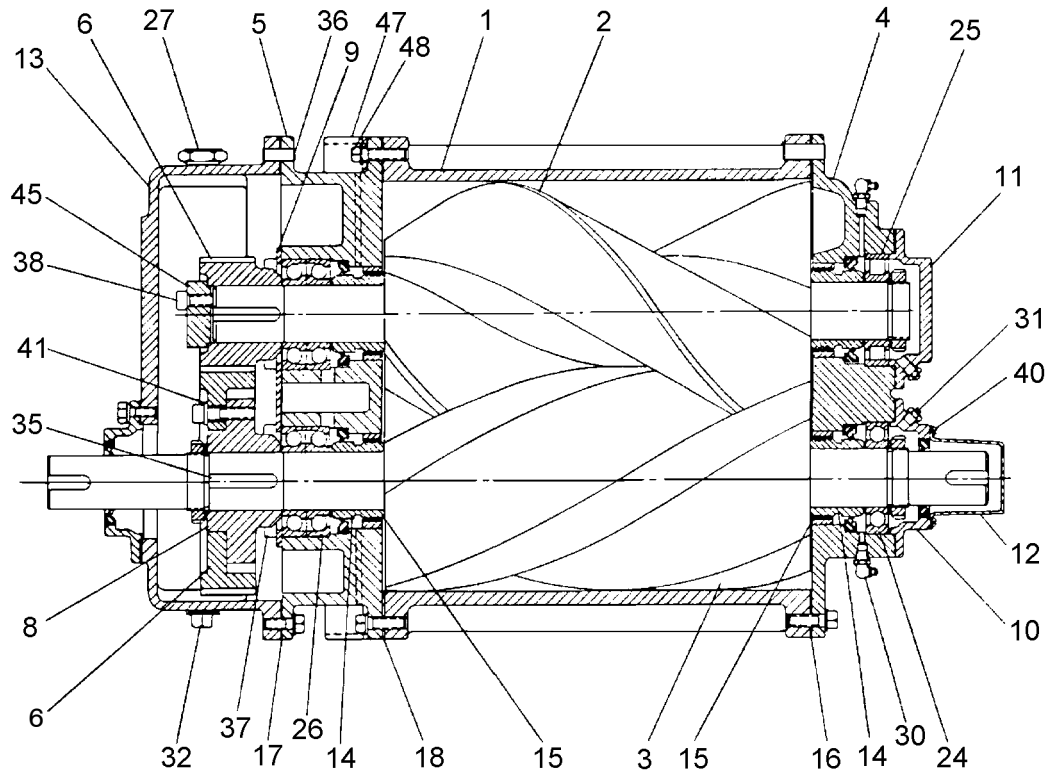
MODEL T5CDL9L CYCLOBLOWER®

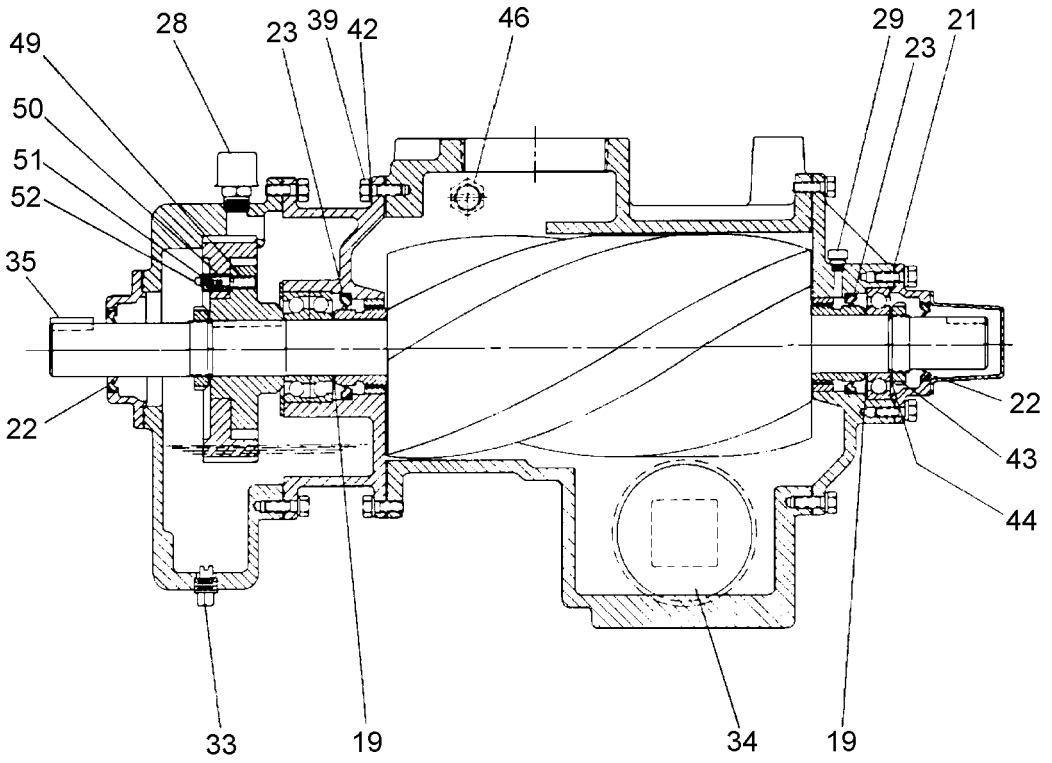
MODEL T5CDL9L PARTS LIST

Order by Part Number and Description. Reference Numbers for your convenience only.

Ref. No.	Description	Qty.	Model T5CDL9L
1	Housing	1	8500422
	Rotor Group, Includes Ref. No. 2 & 3	1	200CTH010A
2	Rotor–Main		
3	Rotor–Gate		
4	Bearing Carrier – Inlet End	1	8500155
5	Bearing Carrier – Discharge End	1	8501180
6	Gear Kit (Includes next two items)	1	200CTH6008
	Gear – Driver	1	
	Gear – Pinion	1	
8	Hub – Gear	1	8500011
9	Clamp Plate – Bearing	1	8500152
10	Cover – End	2	8500151
11	Cover – End	1	8500150
12	Cover – End Shaft	1	8501103
13 *	Cover – End	1	8500436
14	Spacer – Bearing	4	8500148
15	Seal – Rotor Shaft	4	8501081
16	Shim – Housing	1	8500023
17	Gasket – Cover	1	8500030
18	Shim – Housing Set	1	8500029
19	Shim – Shaft Set	2	8501269
21	Gasket – Cover End	3	8500163
22	Seal – Oil Shaft	2	8501240
23	Seal – Oil Bearing	4	60DD513
24	Bearing – Ball Single Row	1	8500165
25	Bearing – Roller Cylindrical	1	8501200
26	Bearing – Angular Contact	4	8500406
27	Gauge – Oil Level	1	40P45
28	Breather Filter	1	5L223
29	Breather Vent	2	5L255
30	Fitting Lube – Grease	2	40E9
31	Fitting Lube – Relief	2	40E37
32	Pipe Plug – SqHd	1	64AA3
33	Plug – Magnetic	1	64BJ4
34	Pipe Plug – Countersunk	2	64B16
35	Key – Square	2	8500109
36	Pin – Dowel	6	62M83
37	Screw – Socket Head Lock	8	75P6N
38	Screw – Socket Head Lock	8	75P57N
39	Screw – Hex Head	56	75A1
40	Screw – Round Head	3	75G17
41	Washer – Plain	4	95U3
42	Washer – Lock	60	95B3
43	Bearing Locknut	3	50Z9
44	Bearing Lock Washer	3	95W25
45	Clamp Plate – Shaft	1	8500414
46	Fusible Plug	1	8501246
47	Cover – Vent	2	8501360
48	Screw – Hex Head	4	75A2
49	Pin – Timing	1	8504125
50	Bushing – Timing	1	8504126
51	Washer – Plain	1	95W17
52	Screw – Socket Head Lock	1	75LM12N

* All parts as listed are for top discharge construction. For units built with top inlet construction, all parts are the same except gear end cover, order as follows: Ref. No. 13 Cover – End, Part Number 8500665.





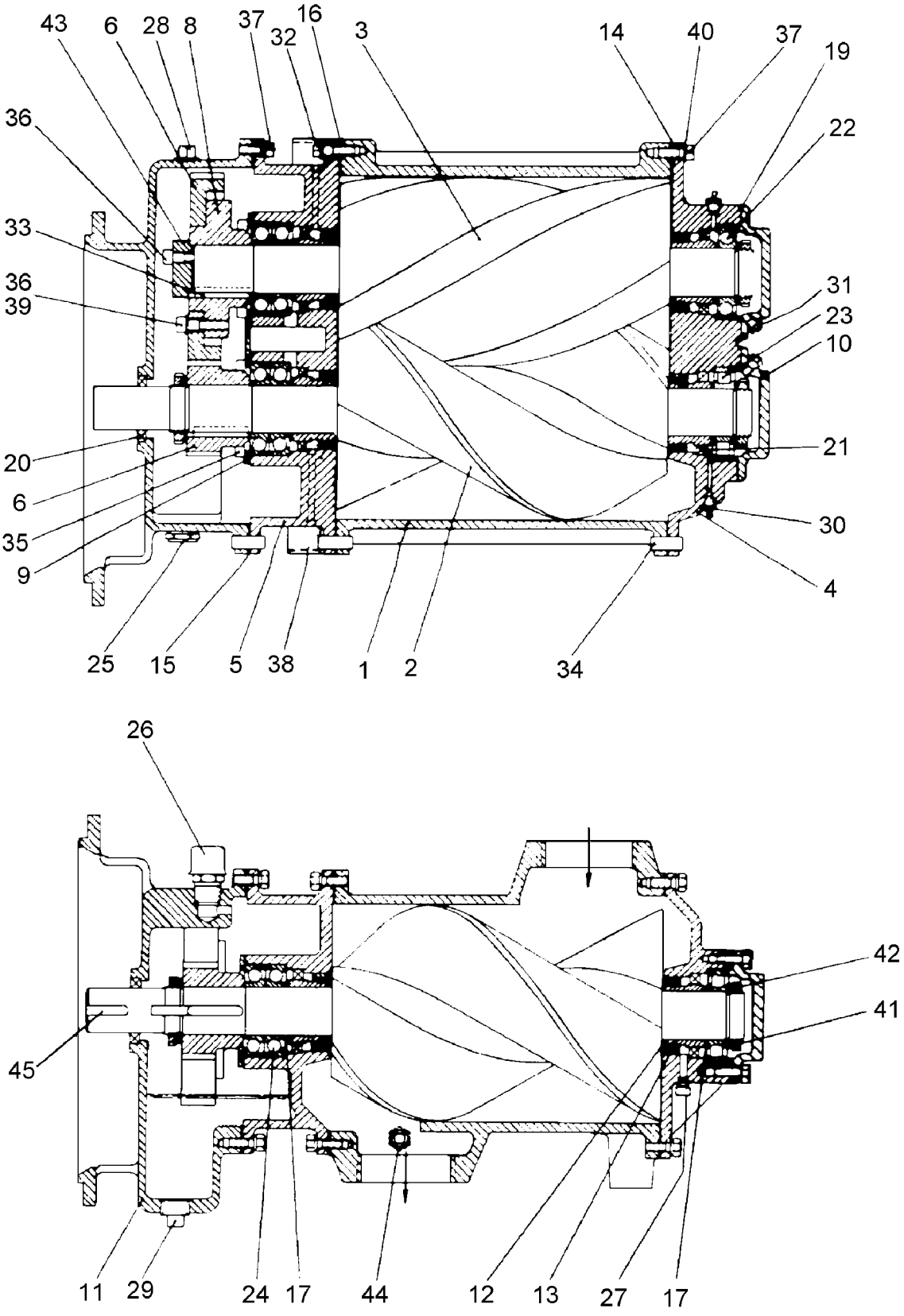
MODEL T5CDL12L CYCLOBLOWER®

MODEL T5CDL12L PARTS LIST

Order by Part Number and Description. Reference Numbers for your convenience only.

Ref. No.	Description	Qty.	Model T5CDL12L
1	Housing	1	200CTH002
	Rotor Group, Incl. Ref. No. 2 & 3	1	208CTH010A
2	Rotor–Main		
3	Rotor–Gate		
4	Bearing Carrier – Inlet End	1	8500155
5	Bearing Carrier – Discharge End	1	8501206
6	Gear Kit (Includes next two items)	1	201CTH6008
	Gear – Driver	1	
	Gear – Pinion	1	
8	Hub – Gear	1	8500011
9	Clamp Plate – Bearing	1	8500152
10	Cover – End	2	8500151
11	Cover – End	1	8500150
12	Cover – Shaft	1	8501103
13*	Cover – End	1	8500436
14	Spacer – Bearing	4	8500148
15	Seal – Rotor Shaft	4	8501081
16	Shim – Housing	1	8500023
17	Gasket – Cover	1	8500030
18	Shim – Housing Set	1	8500029
19	Shim – Shaft Set	2	8501269
21	Gasket – Cover End	3	8500163
22	Seal – Oil Shaft	2	8501240
23	Seal – Oil Bearing	4	60DD513
24	Bearing – Ball	1	8500165
25	Bearing – Roller Cylindrical	1	8501200
26	Bearing – Angular Contact	4	8500406
27	Gauge – Oil Level	1	40P45
28	Breather Filter	1	5L223
29	Breather Vent	2	5L255
30	Fitting Lube – Grease	2	40E9
31	Fitting Lube – Relief	2	40E37
32	Pipe Plug – SqHd	1	64AA3
33	Plug – Magnetic	1	64BJ4
34	Pipe Plug – Countersunk	2	64B10
35	Key – Square	3	8500109
36	Pin – Dowel	6	62M83
37	Screw – Socket Head Lock	8	75P6N
38	Screw – Socket Head Lock	7	75P57N
39	Screw – Hex Head	56	75A1
40	Screw – Round Head	3	75G17
41	Washer – Plain	4	95U3
42	Washer – Lock	56	95B3
43	Bearing Locknut	3	50Z9
44	Bearing Lock Washer	3	95W25
45	Clamp Plate – Shaft	1	8500414
46	Fusible Plug	1	8501246
47	Cover – Vent	2	8501360
48	Screw – Hex Head	4	75A2
49	Pin – Timing	1	8504125
50	Bushing – Timing	1	8504126
51	Washer – Plain	1	95W17
52	Screw – Socket Head Lock	1	75LM12N

* All parts as listed are for top discharge construction. For units built with top inlet construction, all parts are the same except gear end cover, order as follows: Ref. No. 13 Cover – End, Part Number 8500665.

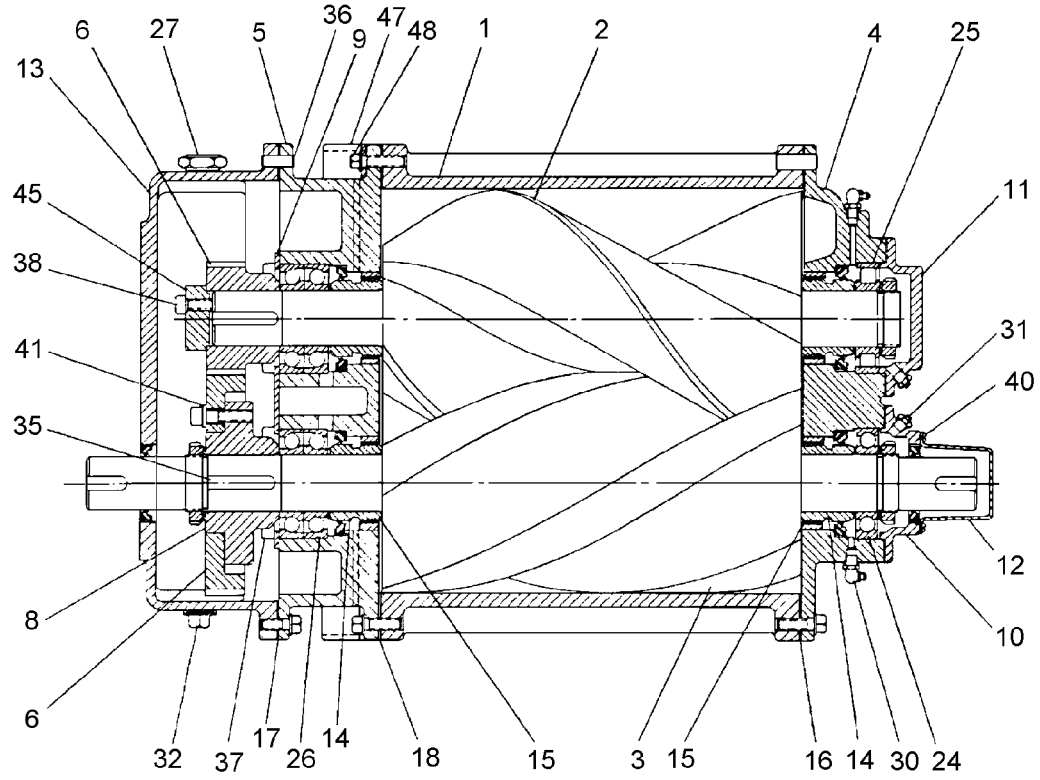


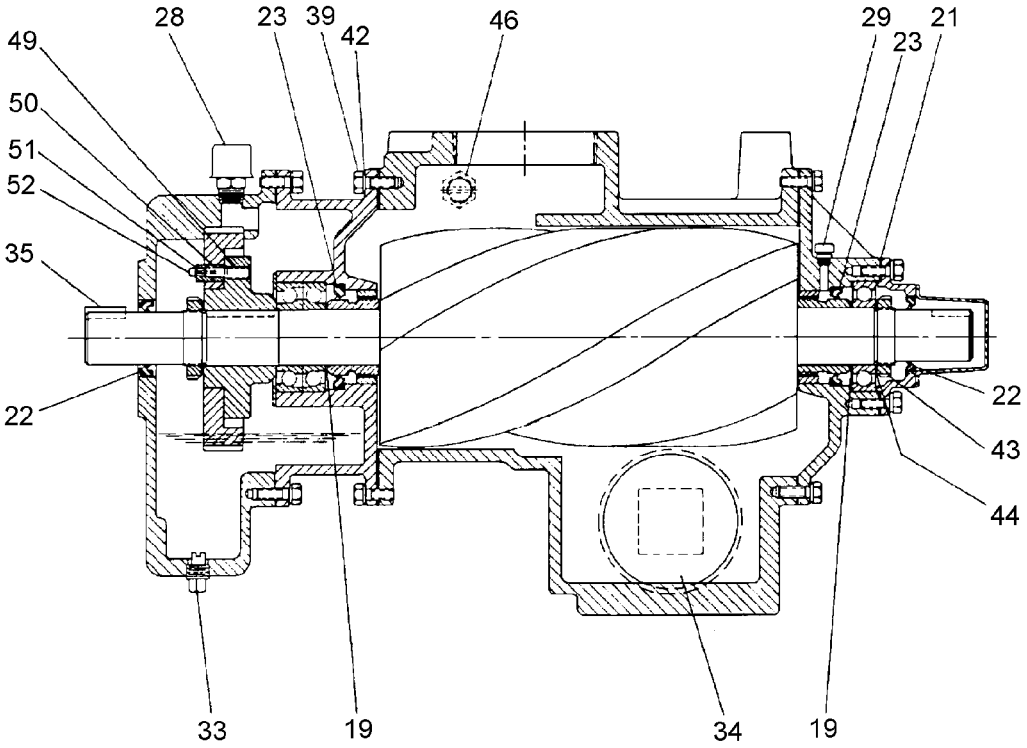
MODEL T5CDL12L9 CYCLOBLOWER®

MODEL T5CDL12L9 PARTS LIST

Order by Part Number and Description. Reference Numbers for your convenience only.

Ref. No.	Description	Qty.	Model T5CDL12L9
1	Housing	1	8500423
	Rotor Group, Incl. Ref. No. 2 & 3	1	205CTH010A
2	Rotor–Main		
3	Rotor–Gate		
4	Bearing Carrier – Suction End	1	8500155
5	Bearing Carrier – Discharge End	1	8501206
6	Gear Kit (Includes next two items)	1	200CTH6008
	Gear – Driver	1	
	Gear – Pinion	1	
8	Gear Hub	1	8500011
9	Bearing Clamp Plate	1	8500152
10	Bearing Cover	2	8500150
11	Gear Cover	1	8500424
12	Bearing Spacer	4	8500148
13	Rotor Shaft Seal	4	8501081
14	Housing Shim	1	8500023
15	Gear Cover Gasket	1	8500030
16	Housing Shim Set	1	8500029
17	Shaft Shim Set	2	8501269
19	Bearing Cover Gasket	2	8500163
20	Shaft Oil Seal	1	8501240
21	Bearing Oil Seal	4	60DD513
22	Ball Bearing	1	8500165
23	Cylinder Roller Bearing	1	8501200
24	Angular Contact Bearing	4	8500406
25	Oil Level Gauge	1	40P45
26	Breather – Filter	1	5L223
27	Vent Breather	2	5L255
28	Pipe Plug, Square Head	1	64AA3
29	Pipe Plug, Magnetic	1	64BJ4
30	Fitting Lube – Grease	2	40E9
31	Fitting Lube – Relief	2	40E37
32	Hex Head Screw	4	75A2
33	Square Key	2	8500109
34	Dowel Pin	6	62M83
35	Socket Head Screw	8	75P6N
36	Socket Head Screw	8	75P57N
37	Hex Head Screw	52	75A1
38	Vent Cover	2	8501360
39	Plain Washer	4	95U3
40	Lock Washer	56	95B3
41	Bearing Locknut	3	50Z9
42	Bearing Lock Washer	3	95W25
43	Shaft Clamp Plate	1	8500414
44	Fusible Plug	1	8501246
45	Square Key	1	8500111
49	Pin – Timing	1	8504125
50	Bushing – Timing	1	8504126
51	Washer – Plain	1	95W17
52	Screw – Socket Head Lock	1	75LM12N





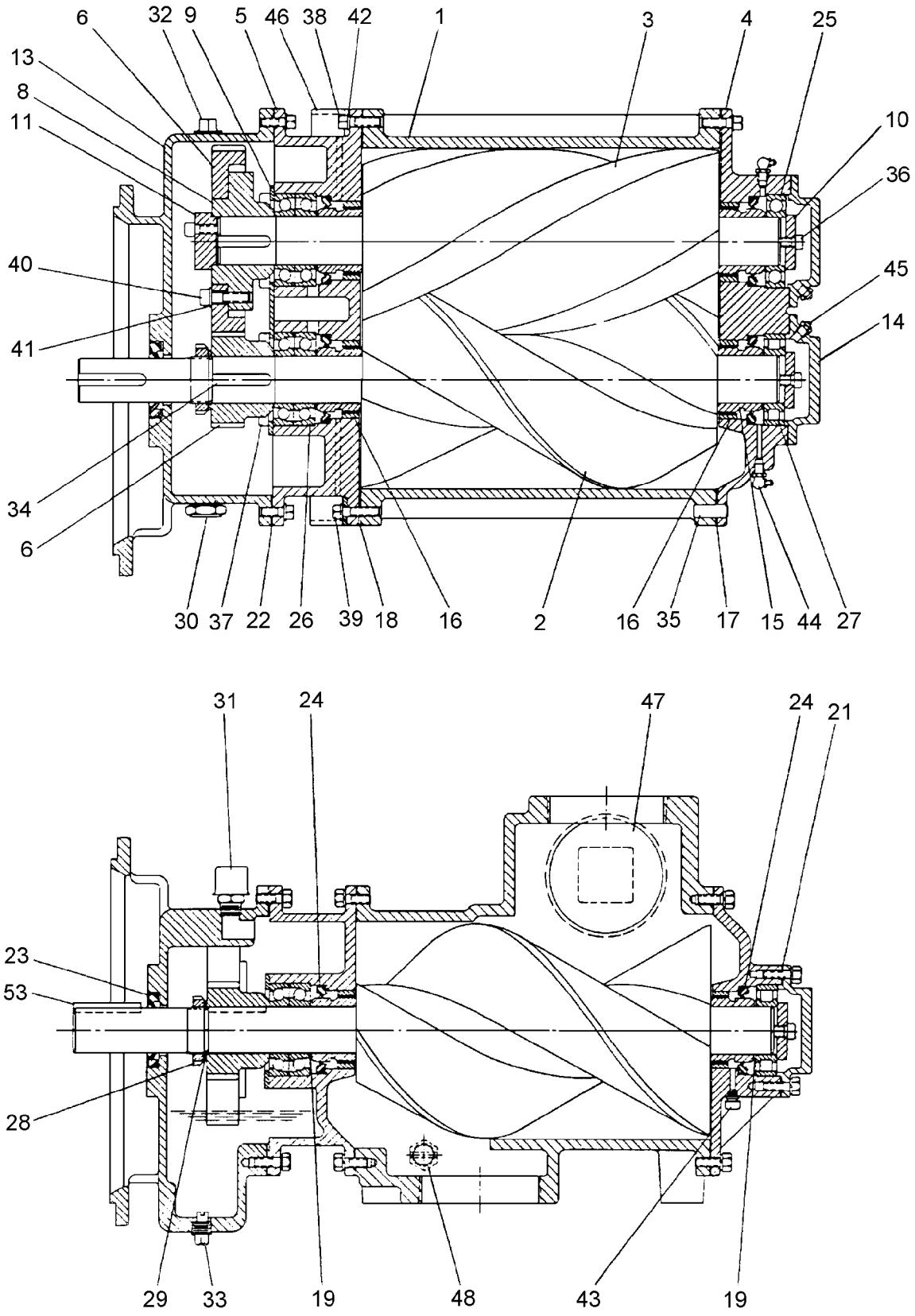
MODEL T5CDL13L CYCLOBLOWER®

MODEL T5CDL13L PARTS LIST

Order by Part Number and Description. Reference Numbers for your convenience only.

Ref. No.	Description	Qty.	Model T5CDL13L
1	Housing	1	8503536
	Rotor Group, Incl. Ref. No. 2 & 3	1	200CTH010B
2	Rotor–Main		
3	Rotor–Gate		
4	Bearing Carrier – Inlet End	1	8500155
5	Bearing Carrier – Discharge End	1	8501206
6	Gear Kit (Includes next two items)	1	201CTH6008
	Gear – Driver	1	
	Gear – Pinion	1	
8	Hub – Gear	1	8500011
9	Clamp Plate – Bearing	1	8500152
10	Cover – End	1	8500151
11	Cover – End	1	8500150
12	Cover – End Shaft	1	8501103
13*	Cover – End	1	8500793
14	Spacer – Bearing	4	8500148
15	Seal – Rotor Shaft	4	8501081
16	Shim – Housing	1	8500023
17	Gasket – Cover	1	8500030
18	Shim – Housing Set	1	8500029
19	Shim – Shaft Set	2	8051269
21	Gasket – Cover End	2	8500163
22	Seal – Oil Shaft	2	8501240
23	Seal – Oil Bearing	4	60DD513
24	Bearing – Ball	1	8500165
25	Bearing – Roller Cylindrical	1	8501200
26	Bearing – Angular Contact	4	8500406
27	Gauge – Oil Level	1	40P45
28	Breather Filter	1	5L223
29	Breather Vent	2	5L255
30	Fitting Lube – Grease	2	40E9
31	Fitting Lube – Relief	2	40E37
32	Pipe Plug – SqHd	1	64AA3
33	Plug – Magnetic	1	64BJ4
34	Pipe Plug – Countersunk	2	64B10
35	Key – Square	3	8500109
36	Pin – Dowel	6	62M83
37	Screw – Socket Head Lock	8	75P6N
38	Screw – Socket Head Lock	7	75P57N
39	Screw – Hex Head	52	75A1
40	Screw – Round Head	3	75G17
41	Washer – Plain	4	95U3
42	Washer – Lock	56	95B3
43	Bearing Locknut	3	50Z9
44	Bearing Lock Washer	3	95W25
45	Clamp Plate – Shaft	1	8500414
46	Fusible Plug	1	8501246
47	Cover – Vent	2	8501360
48	Screw – Hex Head	4	75A2
49	Pin – Timing	1	8504125
50	Bushing – Timing	1	8504126
51	Washer – Plain	1	95W17
52	Screw – Socket Head Lock	1	75LM12N

* All parts as listed are for top discharge construction. For units built with top inlet construction, all parts are the same except gear end cover, order as follows: Ref. No. 13 Cover – End, Part Number 8500792.



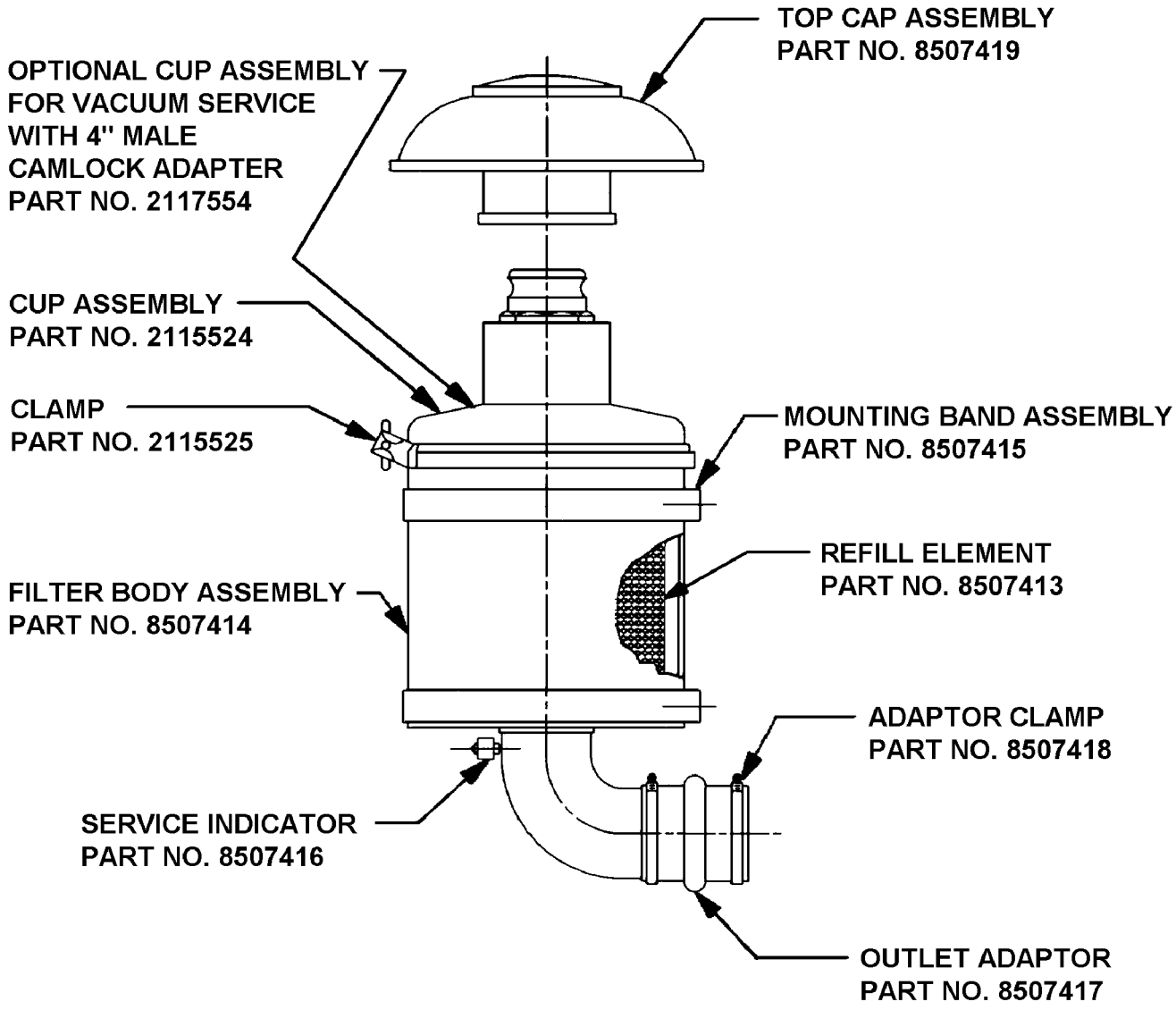
MODEL T5CDL13L9 CYCLOBLOWER®

MODEL T5CDL13L9 PARTS LIST

Order by Part Number and Description. Reference Numbers for your convenience only.

Ref. No.	Description	Qty.	Model T5CDL13L9
1	Housing	1	8503536
	Rotor Group, Incl. Ref. No. 2 & 3	1	210CAH010A
2	Rotor–Main		
3	Rotor–Gate		
4	Bearing Carrier – Inlet End	1	8500155
5	Bearing Carrier – Discharge End	1	8501206
6	Gear Kit (Includes next two items)	1	200CTH6008
	Gear – Driver	1	
	Gear – Pinion	1	
8	Hub – Gear	1	8500011
9	Clamp Plate – Bearing	1	8500152
10	Clamp Plate – Shaft	2	8500147
11	Clamp Plate – Shaft	1	8500414
13	Cover – End	1	8500424
14	Cover – End	2	8500150
15	Bearing Spacer	4	8500148
16	Seal – Rotor Shaft	4	8501081
17	Shim – Housing	1	8500023
18	Shim – Housing Set	1	8500029
19	Shim – Shaft Set	2	8501269
21	Gasket – Cover End	2	8500163
22	Gasket – Cover	1	8500030
23	Seal – Oil	1	8501240
24	Seal – Oil	4	60DD513
25	Bearing – Ball	1	8500165
26	Bearing – Angular Contact	4	8500406
27	Bearing – Roller Cylindrical	1	8501200
28	Bearing Locknut	1	50Z9
29	Bearing Lock Washer	1	95W25
30	Gauge – Oil Level	1	40P45
31	Breather Filter	1	5L223
32	Pipe Plug – SqHd	1	64AA3
33	Plug – Magnetic	1	64BJ4
34	Key – Square	2	8500109
35	Pin – Dowel	6	62M83
36	Screw – Socket Head Lock	6	75P56N
37	Screw – Socket Head Lock	8	75P6N
38	Screw – Hex Head	52	75A1
39	Screw – Hex Head	4	75A2
40	Screw – Socket Head Lock	8	75P57N
41	Washer – Plain	4	95U3
42	Washer – Lock	56	95B3
43	Breather Vent	2	5L255
44	Fitting – Lube Grease	2	40E9
45	Fitting – Lube Relief	2	40E37
46	Cover – Vent	2	8501360
47	Pipe Plug – Countersunk	2	64B10
48	Fusible Plug	1	8501246
49	Pin – Timing	1	8504125
50	Bushing – Timing	1	8504126
51	Washer – Plain	1	95W17
52	Screw – Socket Head Lock	1	75LM12N
53	Key – Square	1	8500112

FILTER PARTS LIST



REFER TO DRAWING NUMBER 37-2-402 OR 37-2-443 FOR DIMENSIONS.

TRUCK BLOWER DRY TYPE AIR FILTER ASSEMBLY - PART NUMBER 8507177

NOTES:

Filter Assembly for Vacuum Service is Part Number 5L311.

Optional Cup Assembly for Vacuum Service, Part Number 2117554, is interchangeable with Cup Assembly Part Number 2115524.

SECTION 6
DISASSEMBLY INSTRUCTIONS

NOTICE

Blowers are made to American (English) specifications. Metric equivalents are not shown in this section.

Disassemble as follows:

1. Remove suction end bearing covers.
2. Remove bearing retainer nuts and lockwasher.
3. Drive out the two bearing carrier flange dowel pins and remove suction end bearing carrier cap screws.
4. Using four jack bolts through tapped holes in the suction end bearing carrier flange, pull the carrier and bearings as an assembly. Be sure to pull evenly.
5. Further disassembly of bearing carriers is not necessary at this point. See Step 1 of Assembly Section for removal and inspection of parts.
6. Drive out the two gear end dowel pins and remove the cover.
7. Remove the shaft clamp plate and oil slinger (if used).

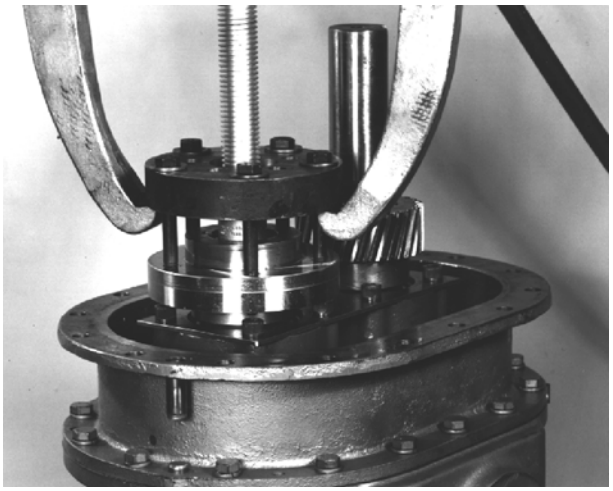
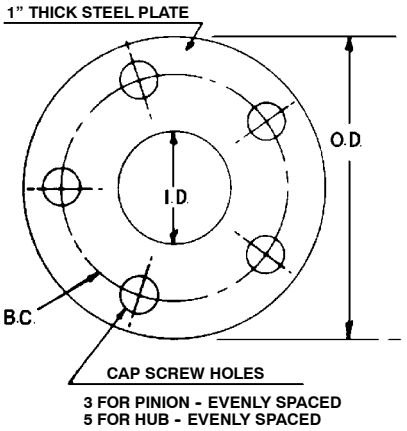


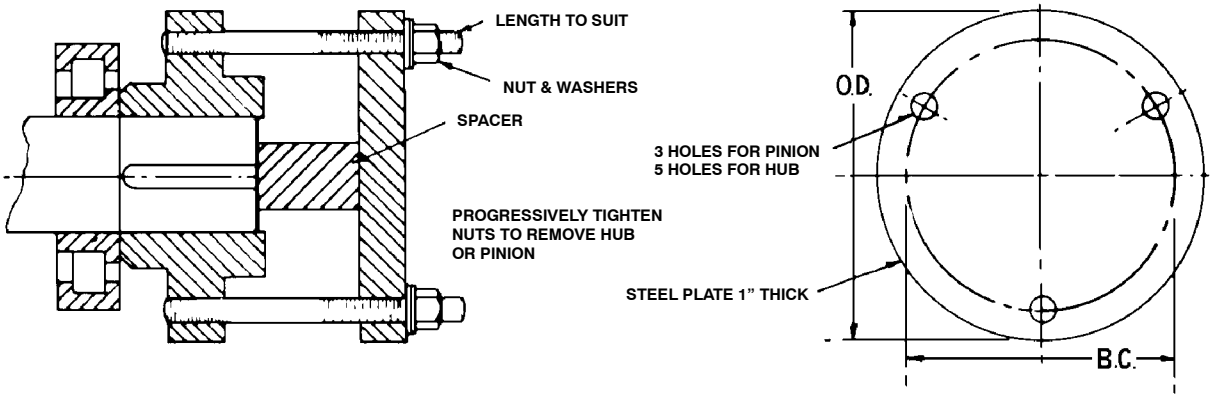
FIGURE 1

8. Remove the pinion locknut.
9. If gears and rotors are to be reused, mark the gear, gear hub, and pinion for easier reassembly.
10. Loosen and remove four socket head cap screws and flat washers. Then remove No. 8–32 screw and washer. Install a 1/2" 13 NC nut on the threaded portion of the timing bushing, tighten the nut until the bushing is loose and can



PULLER ADAPTOR PLATE DIMENSIONS				
O.D.	I.D.	B.C.	Holes	Screw
PINION				
3–3/4"	1–3/4"	2–1/2"	3–7/16"	3/8" – 16 UNC
GEAR HUB				
5"	1–3/4"	4"	5–7/16"	3/8" – 16 UNC

FIGURE 2 - PULLER ADAPTOR PLATE DIMENSIONS



DIMENSIONS

PINION				GEAR HUB			
O.D.	B.C.	Holes	Stud	O.D.	B.C.	Holes	Stud
3-3/4"	2-1/2"	3-7/16"	3/8" - 16 UNC	5"	4"	5-7/16"	3/8" - 16 UNC

FIGURE 3 - DIMENSIONS

be lifted from the gear. Unscrew the timing pin. The gear is slip fit on the hub. Remove by tapping lightly with a soft-face hammer.

11. Jam a block of hard wood between the rotors to prevent rotation while pulling the gear hub and pinion.

12. Pull the gear hub and pinion. If the gear hub and pinion are pulled with jaw type puller as shown in FIGURE 1, Page 27 and FIGURE 4, Page 29, an adaptor plate must be provided.

NOTICE

Pulling directly on the pinion teeth will damage teeth making timing difficult and cause gear wear. Pulling directly on the gear hub flange will distort the flange causing gear run-out. Always use a shaft protector.

Adaptor plate dimensions are given in FIGURE 2, Page 27. If a hydraulic or jaw puller is not available, the hub and pinion may be pulled as shown in FIGURE 3. Do not use a torch to heat pinion to aid in removal; pinion can be damaged by concentrated heat.

NOTICE

For ease of disassembly and assembly, the rotor shaft, pinion and gear hub are made with a slight taper fit.

13. Remove the bearing clamp plate.

14. Bearings are a light press fit on the shaft. Press each rotor shaft through the bearing (FIGURE 5, page 29). As the shaft is pressed through, be careful that the rotor does not fall and damage the opposite end of the shaft. Support the puller so it does not fall when the rotor drops free of the bearing. If a puller or press is not available, tap the rotors through with a block of hard wood and a hammer.

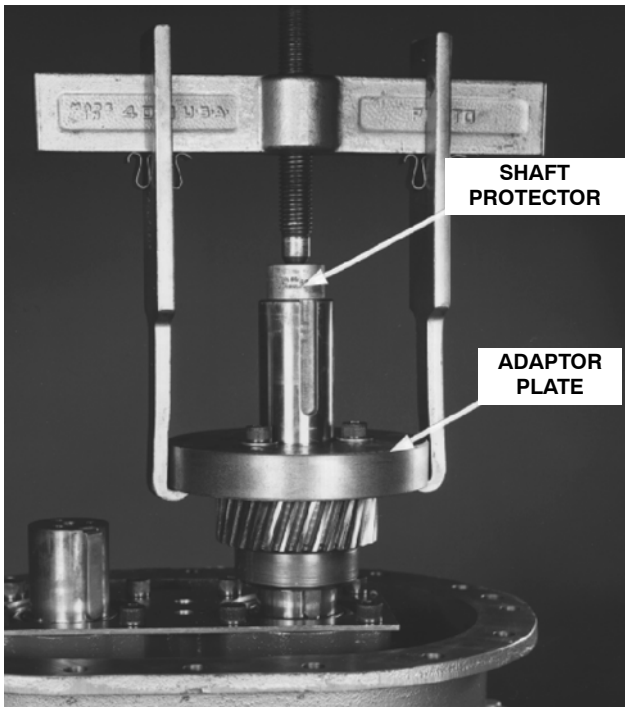


FIGURE 4

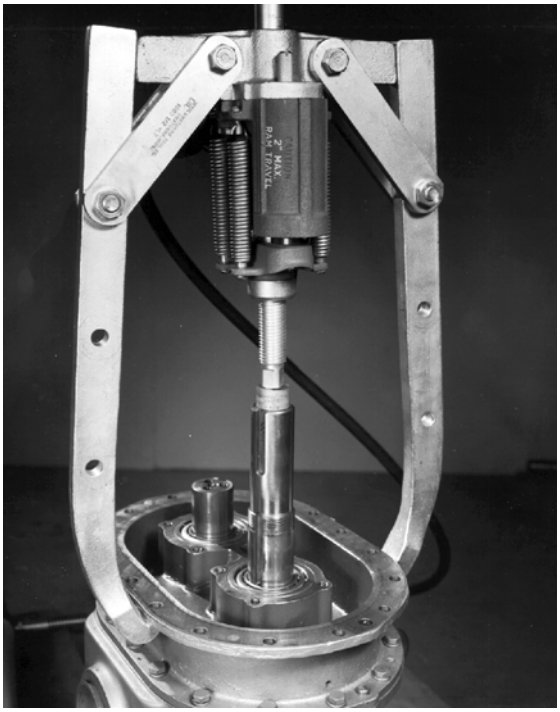


FIGURE 5

NOTICE

If bearings are seized on the shaft, do not apply force on the flange of the carrier as breakage may result.

15. Drive out the two gear end, bearing carrier to housing, dowel pins and remove the carrier (2).

NOTICE

Seals and bearings should be replaced during overhaul as a matter of service policy.

SECTION 7
ASSEMBLY INSTRUCTIONS

NOTICE

Blowers are made to American (English) specifications. Metric equivalents are not shown in this section.

The CycloBlower® is manufactured with close tolerances for efficient operation. All parts must be handled carefully to prevent burrs which will give false tolerance readings and/or cause rapid wear. All parts must be thoroughly cleaned of dirt which will cause galling of close running parts. Clean work area, washing tank, tools and wiping rags must be provided. Refer to parts list section for sectional view showing complete assembly of parts.

There may be cases where foreign materials have entered the blower, or other causes have resulted in scoring of rotor ends, bearing carrier faces, rotor lobes, or housing walls. Since the blower is designed with no contact of parts within the rotor chamber, these parts may be cleaned and polished for reuse unless galling is severe. Reuse of parts severely scored may result in loss of blower efficiency. All damaged parts which have been reworked should be checked for run-out or warpage before reuse.

1. Remove bearings and oil seals (lip seals) from both bearing carriers. Remove with care so as not to damage the bronze-filled Teflon lining of the rotor shaft seal since it may be reusable. NOTE: If bearings are to be reused, keep the races in matched sets. Never reuse worn bearings. The rotor shaft seal may be reused if:

   a. The bronze-filled Teflon lining isn't obviously damaged (circumferential grooves are normal in seals after service).

   b. The clearance between the O.D. of the bearing spacer and the I.D. of the seal is no more than .004, FIGURE 1. This clearance can be checked with a feeler gauge. Greater clearance will cause excessive air leakage and lower blower efficiency. When checking the rotor shaft seal for clearance be sure there are no burrs on seal or bearing spacer. If the shaft seal can be reused, skip Step 2 and proceed with Step 3.

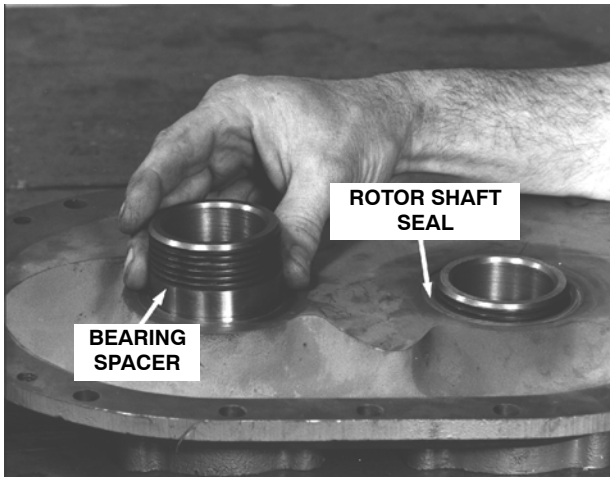


FIGURE 1

   If the shaft seals are to be replaced, remove the old seal and proceed with Step 2.

   c. Babbitt seals cannot be reused and must be replaced with teflon lined seals.

2. Install rotor shaft seals in both bearing carriers, FIGURE 2. Press or drive the seal about .015 below flush to prevent interference with the end of the rotor. .015 shim stock (cut to the same diameter as the seal) placed over the end of the seal will allow it to be driven to proper depth. A

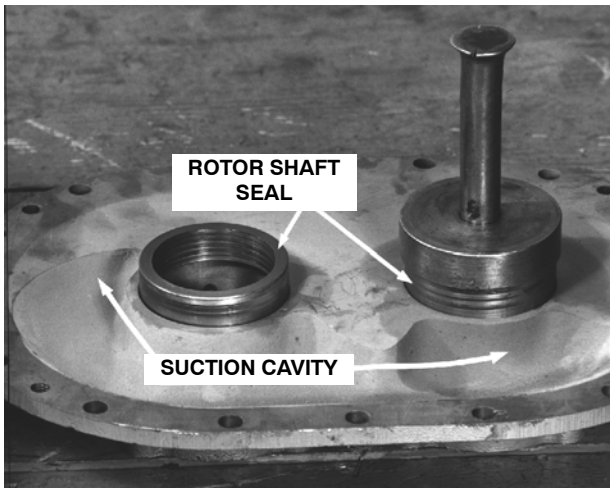


FIGURE 2

flat driver as shown in FIGURE 2, page 30 will prevent damage to the seal. Oil the O.D. of the seal to prevent seizure in the bore. Check the clearance of the spacer and seal as described in Step 1.

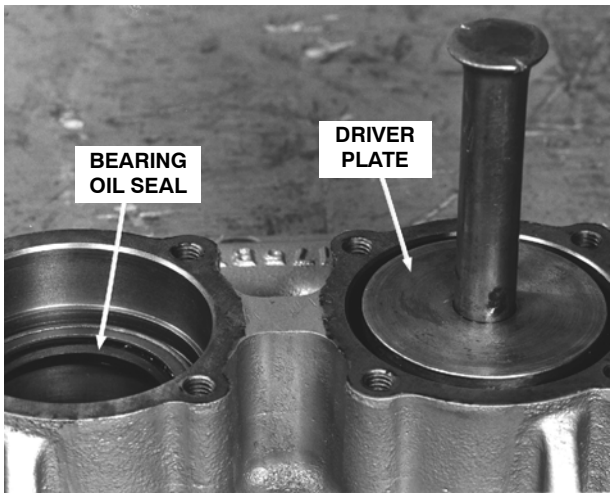


FIGURE 3

3. Install oil seals in the bearing carriers, FIGURE 3, lip of seal points toward bearing bore. Seal bottoms against the shoulder in the bore. Use sealing compound on the O.D. of the seal for ease of installation and prevention of leakage around the seal. Be sure the driver used is large enough to bear against the outer ring of the seal case to prevent damage to the case and distortion of the seal lip. Use only seals shown in the parts list as they are selected for blower service.

4. Install suction bearing carrier and .030" aluminum gasket on the housing. Match the cavity on the flat side of the carrier with the suction opening on the housing (FIGURE 4). Insert dowel pins before pulling cap screws tight.

5. Stand the housing and bearing carrier on blocks as shown in FIGURE 5. Make sure there are no burrs on either side of the spacer or end of the rotor. Apply Loctite to the shaft extension of the rotor in the area where the bearing spacer will be located. Slide bearing spacers on the suction end of the rotor shaft with spacer grooves toward the rotor. Be sure the bearing spacer fits square against the end of rotor. With the spacer seated against the face of the rotor, spin the spacer on the shaft several times to evenly spread the

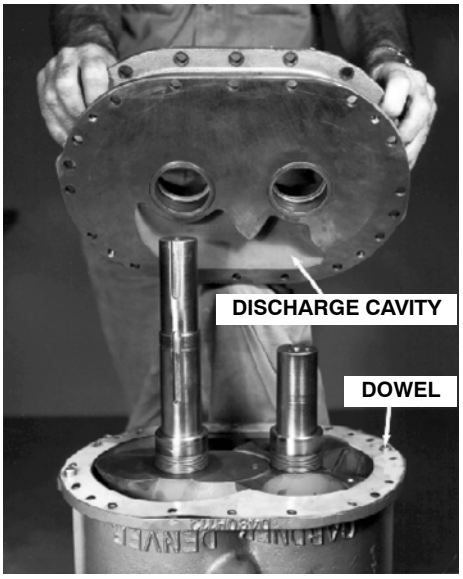


FIGURE 4

loctite. Tape bearing spacers to the shaft to hold in place while lowering rotors into the housing. Install the gate rotor first. If the main rotor is installed first, the gate rotor bearing spacer O.D. will drag the top of the main rotor lobes. Do not damage seals when inserting the shaft. Blocks must be high enough so rotor shafts hang free and allow the end of the rotor to rest solidly on the bearing carrier.

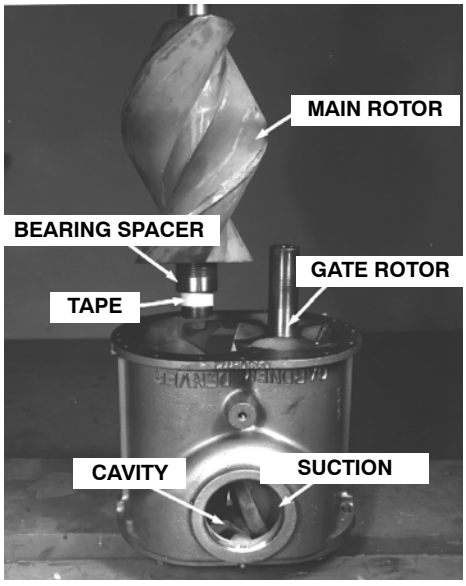


FIGURE 5

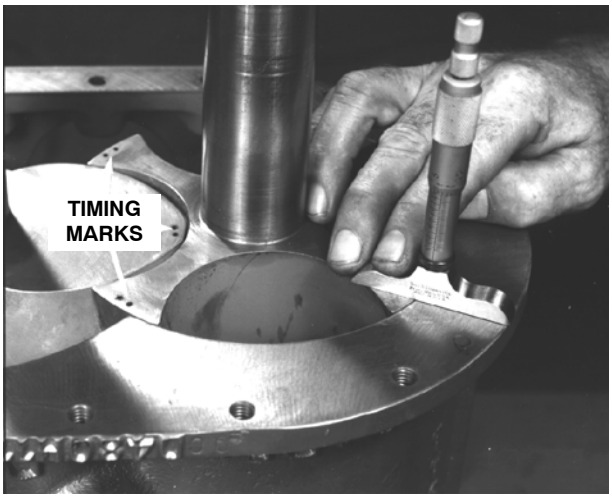


FIGURE 6

6. Rotate rotors to be sure they are resting squarely on the bearing carrier. Using a depth micrometer, measure the distance from the end of each rotor lobe to the face of the housing flange (FIGURE 6). Rotate rotors so all lobes can be checked, and use the greatest reading.

7. Add the greatest micrometer reading to the total end (suction plus discharge) clearance shown in Clearance Chart (FIGURE 7). This sum determines the amount of housing shims (required at the gear end. Housing shims are made of aluminum and are furnished in varying thicknesses as a set. Each shim is marked for thickness.

	Total End Clearance (Suction and Discharge)	Suction End	Discharge End
T5CDL9	.020”	.014”	.006”
T5CDL12	.021”	.015”	.006”
T5CDL13	.023”	.016”	.007”

NOTE: Dimensions are for ideal clearances. Never allow more than +/- .001” tolerance.

FIGURE 7 - ROTOR CLEARANCE CHART (UNIT COLD)

EXAMPLE: For T5CDL12 blower: A micrometer reading shows rotors are above the housing .006”, plus total end clearance of .021” equals .027” measured clearance. Add .002” for shim crush, and total shim set thickness equals .029”. If rotors measure .006” shorter than the housing, subtract this reading from .021” total end clearance, add .002” crush, and total shim set thickness is .017”.

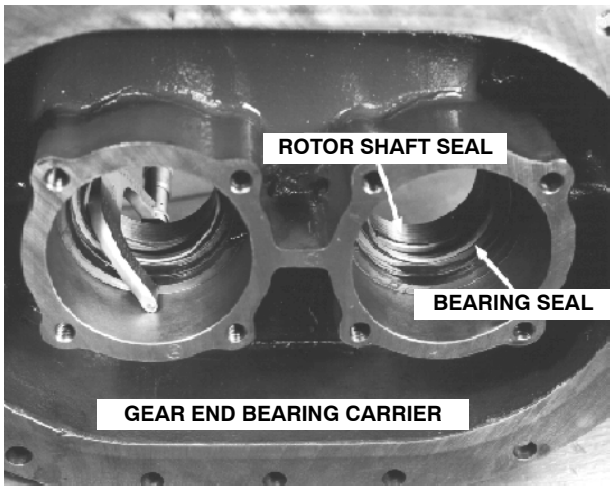


FIGURE 8

8. With 0 to 2 inch outside micrometer, measure thickness from rotor side of the carrier to bearing shoulder in the bearing bore (FIGURE 8). Record this measurement for each bore.

9. Measure the length of the two bearing spacers (FIGURE 9). Match each bearing spacer length with thickness measurements made in Step 7 to determine the discharge end clearance. If the spacers do not measure longer than the bearing carrier by the required amount shown in the clearance chart (FIGURE 7) under the discharge end, shims must be added at the end of the spacers to make up the difference.

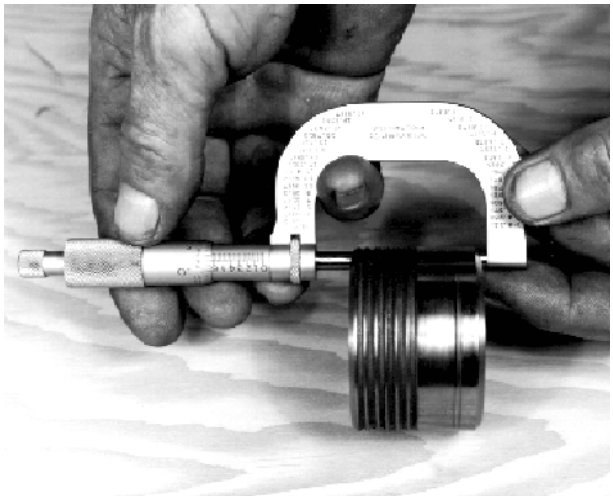


FIGURE 9

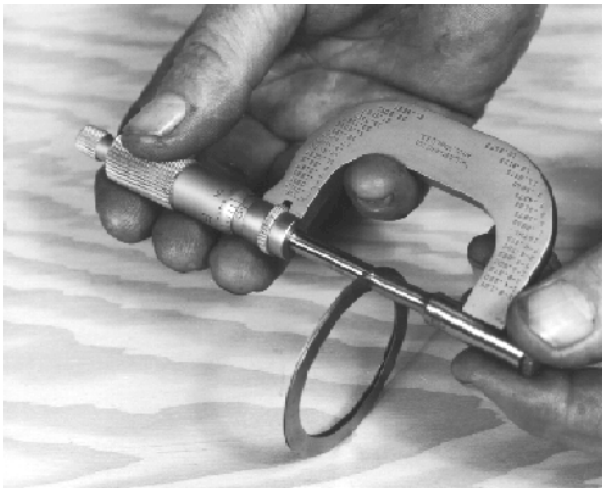


FIGURE 10

EXAMPLE: If the bearing spacer measures 1.633" (Step 9) and the carrier measures 1.630" (Step 8) giving a difference of only .003", then .003" shims plus .002" shims for crush fit must be added to give the required .006" discharge end clearance.

10. Mic shims to be sure of thickness (FIGURE 10).

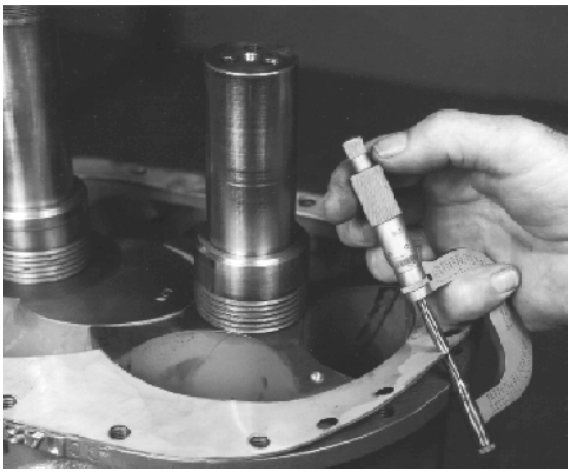


FIGURE 11

11. Make sure there are no burrs on either side of the spacer or end of the rotor. Apply Loctite to the shaft extension of the rotor in the area where the bearing spacer will be located. Slide bearing spacers over gear end of the rotor shaft (FIGURE 11) with grooves towards the rotor. With the spacer seated against the face of the rotor, spin the spacer on the shaft several times to evenly spread the loctite. Note that the spacer and shaft were matched to the individual bore (Step 8); this relation must be maintained. To check this relationship, match the discharge end bearing carrier cavity (shown in FIGURE 12) with the discharge opening in housing.

⚠ CAUTION

Do not install spacer shims yet, as they may cause damage to seals when bearing carrier is installed.

Grease the O.D. of the bearing spacer and the I.D. of the seals with a Moly base grease for break-in purposes.

Place the amount of aluminum shims, established in Step 5, on the end of the housing (FIGURE 11). Mic shims, to be sure of thickness.

12. Drive two dowels in the flange of the housing. Lower the discharge end bearing carrier in place. Do not damage lip seals as they pass over the ends of the shafts. Match the discharge cavity in the carrier with the discharge opening in the housing (FIGURE 12). Be sure dowels are through both flanges before pulling cap screws tight. Place shims, if used, established in Step 8, over the shaft and against the end of the bearing spacers.

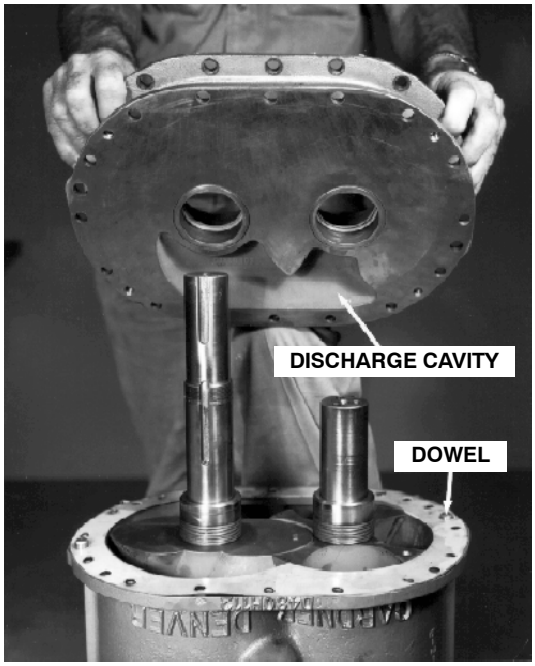


FIGURE 12

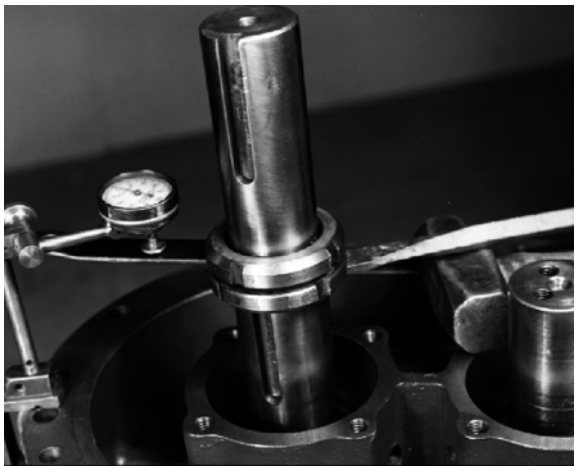


FIGURE 13

13. Check the total end clearance with dial indicator clamped on the discharge end carrier flange. The indicator button should rest on the steel strap clamp between the two bearing locknuts. (FIGURE 13). Set dial on zero and lift rotor with pry bar placed under locknuts. With rotor as high as it will go, the indicator reading should be equal to the total end clearance established in Step 5. To check the clearance on the other rotor, rest indicator button on the end of the shaft. Lift the rotor by means of an eye bolt screwed into one of the tapped holes and pry bar through eye bolt.

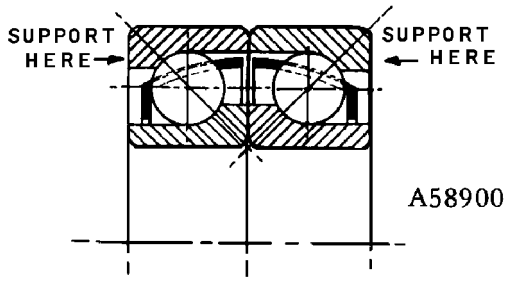


FIGURE 14 - BEARING INSTALLATION

NOTICE

Do not hammer bearings of this size in place.

14. Assemble angular contact ball bearings (16) on each rotor shaft at the gear end as shown in FIGURE 14. The marked face of the inner bearing is placed down in “bore”; the marked face of the outer bearing is placed up. The bearings are a slip fit in the bore and a press fit on the shaft. Use lubricant on both inner and outer races for easier installation.



FIGURE 15

15. Assemble the press plate, FIGURE 15, and press bearings in the bore.

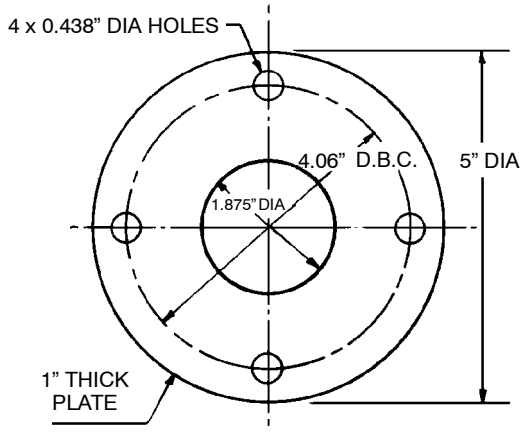


FIGURE 16 - PRESS PLATE DIMENSIONS

16. FIGURE 16 gives the dimensions of the press plate. Tighten nuts on the jack screw evenly to prevent cocking of the bearing on the shaft and in the bore. It is not recommended to hammer bearings in place as damage to bearing will result. Bearings must be completely seated against the shoulder in the bearing carrier.

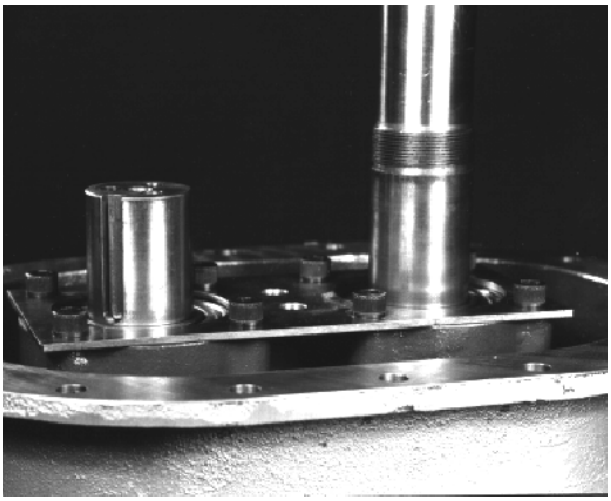


FIGURE 17

17. Install the bearing clamp plate (17) and secure with “Nylok” type screws (FIGURE 17).

18. Check the fit of the keys in the pinion and gear hub. Fit keys to both rotor shafts for installation of the pinion and gear hub.

    For ease of disassembly and assembly, the rotor shafts and bore of the pinion and gear hub are tapered. Jam a piece of hard wood or leather belting between rotors to prevent turning while installing the gear hub and pinion.

NOTICE

FIGURE 18 shows a long shaft extension on the main rotor. On some models the long shaft extension is on the gate rotor. BE SURE TO INSTALL THE PINION AND SHAFT CLAMP PLATE ON THE MAIN ROTOR SHAFT.

Heat the gear hub and pinion in oil or dry heat – NEVER USE TORCH – between 163° C and 177° C (325° F. and 350° F.). Allow heat to penetrate for 30 minutes minimum. Slip the pinion on the main rotor, install shaft clamp plate upside down with pilot up (FIGURE 18) and pull up tight. Slip the gear hub on the gate rotor, install lockwasher and locknut and pull up tight (FIGURE 18). Tightening the locking device is very important as this operation pulls the rotor shaft through the bearings until the bearing spacer and shim (if used) are clamped solidly between the rotor end and bearing, assuring a fixed position of the rotor. As the pinion and hub cool, retighten the clamp plate and locknut.

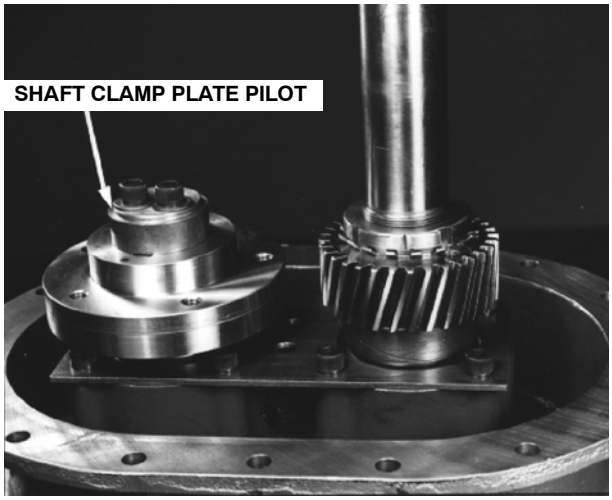


FIGURE 18

After the pinion and gear hub are cooled and tight, check the discharge end clearance between the ends of the rotor and discharge end bearing carrier using a feeler gauge through the discharge opening. Check the rotor at the suction end with feeler gauge through the suction opening. These clearances should coincide with figures listed in the clearance chart, FIGURE 7, Page 32. The gear will be installed in Step 24.



FIGURE 19

19. Turn the blower over to install bearings in the suction end carrier. Remove the tape holding the bearing spacers in place. Place a machined

bar such as the base of a dial indicator across the bearing bore on the carrier plate.

Be certain the face of the bore is smooth and the bar lies perfectly flat. With depth micrometer, measure the distance from the bar to the shoulder in the bore and record figure for both bearing bores (FIGURE 19, page 35).



FIGURE 20

20. Move the bar and depth mic to the end of the bearing spacer (FIGURE 20). Bearing spacers (10) must be tight against the end of rotors. Add bearing spacer shims like those used in FIGURE 10, Page 33, to the end of the bearing spacer so the depth reading is from .005" to .010" less than the reading obtained in Step 18. This clearance provides "float" for the bearing outer race.

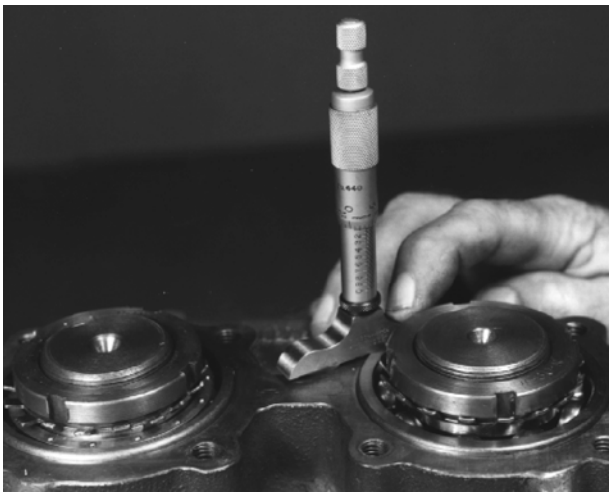


FIGURE 21

21. Install the ball bearings on the gate rotor and roller bearing on the main rotor. Oil bore and shaft for easier assembly. Use press plate, shown in FIGURE 15, Page 34, to press bearings in place. Install the lockwasher into the slot of the nut. Bend the ear of the lockwasher into the slot of the locknut.

    With depth micrometer measure the distance from the bearing to the carrier face on both sides (FIGURE 21).

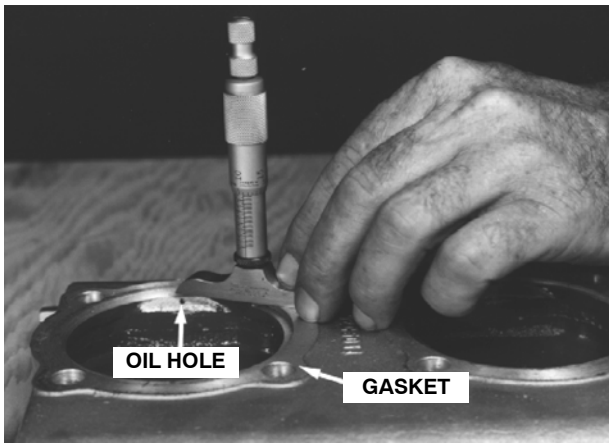


FIGURE 22

22. With the gasket in place, measure the depth of counterbore in the bearing covers (FIGURE 22). This measurement must be at least .010" greater than the largest reading obtained in Step 20 to provide for float of bearing outer race. If reading is less than .010", add additional gaskets.

    Grease the bearings, refer to "Lubrication", Maintenance, Section 4, Page 10, and install the covers.

TIMING OF ROTORS

23. Stand the unit with the gear end up. Slip the gear on the hub. The gear must be positioned so tapped holes in the hub are near the center of the holes in the gear. This is necessary to allow movement of the gear on the hub for timing. Use old timing bolts until the correct timing is achieved. Tighten screws against the flat washer just enough to allow the gear to slip radially on the hub. Always use new washers when timing the blower. Once timing is fixed, replace old bolts, one at a time, with "Nylok" type screws.

    Provide 3/8" – 16 stud turned down on one end to fit the indicator clamp for indicator support (FIGURE 23, page 37). Use flat metal stock bolted to the end of the shaft for indicator button

bracket. Indicator must be mounted clockwise of the button bracket to follow the next steps in timing.

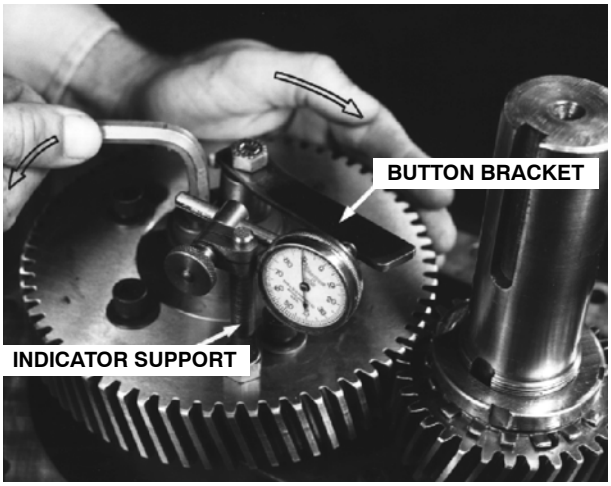


FIGURE 23

Set the indicator at zero. Hold the gear under pressure clockwise to take up all backlash. Gear backlash is .002/.004. While holding pressure on the gear, rotate the rotor counterclockwise with an Allen wrench in one of the shaft screws as a lever. Do not rotate the assembly by moving the gear; use a wrench only.



FIGURE 24

Make two complete revolutions; if at any time the indicator moves to the plus side of zero, reset the indicator to zero and again make two complete revolutions. Note the smallest reading (this is the smallest number of thousandths from zero and not the smallest figure on the indicator dial).

Continue rotation and stop at this point and reset the indicator to zero. This is the closest clearance of the rotors in this direction. If the indicator pointer flutters at any point during rotation, check for burrs or dirt on the rotors or gear teeth.

24. While holding the gear under pressure counterclockwise (FIGURE 24), rotate the rotor clockwise two complete revolutions, and note the smallest indicator reading. Continue rotation and stop the indicator at the smallest reading. This is the point of minimum total interlobe clearance.

25. The interlobe clearance is divided 2/3 on the discharge side and 1/3 on the suction side. Hold gear from turning (FIGURE 25, page 37) and move rotor counterclockwise with wrench just enough to obtain 1/3 of the indicator reading obtained in Step 24. For Example: The indicator reading is +15. Then move the rotor counterclockwise until the indicator reads +10.

    Tighten the gear to hub screws evenly. Be sure the indicator reading does not change. Check interlobe clearance to make sure the 2/3 indicator reading is on the discharge side. Discharge side clearance is checked with a feeler gauge through the discharge opening in the housing. The rotors are held in time by clamp action of the screws. Rotate blower several times to be sure timing has not slipped.

26. Installation of the timing pin and bushing (see FIGURE 26, page 38).

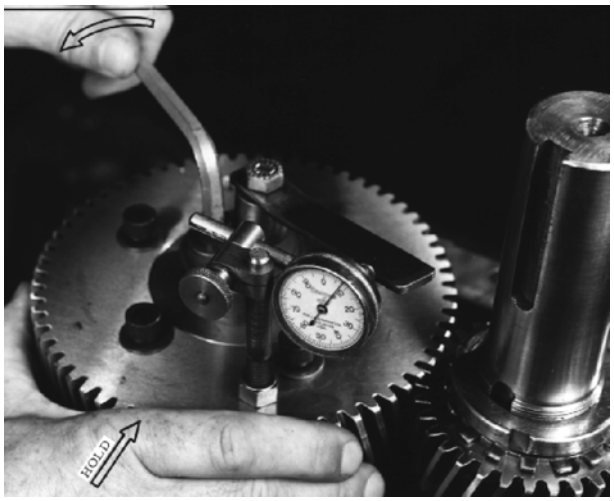


FIGURE 25

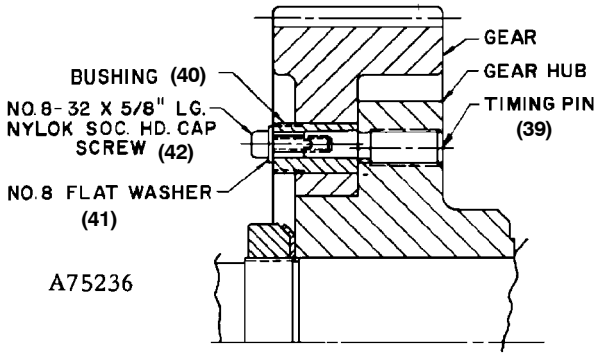


FIGURE 26 - TIMING PIN AND BUSHING

a. Set the timing and lock in place with four (4) Nylok socket head cap screws and new washers.

b. Install timing pin part number 8504125 in 3/8" tapped hole in the gear hub. Turn the pin into the hub until the threaded end of the pin is flush with the back of the gear hub.

c. Place bushing in 1/2" diameter hole in the gear over the tapered end of the timing pin. If the tapered hole in the bushing does not line up with the tapered pin, insert screwdriver through the bushing and turn the pin counterclockwise until the bushing drops down over the pin.

d. Install No. 8-32 UNC x 5/8" lg. socket head cap screw and flat washer in the end of the pin and draw up tight.

Note: To remove timing pin and bushing, first loosen and remove four socket head cap screws and flat washers. Then remove No. 8-32 UNC screw and flat washer. Install a 1/2" 13 NC nut on the threaded portion of the timing bushing, tighten the nut until the bushing is loose and can be lifted from the gear. Unscrew the timing pin. The gear is slip fit on the hub. Remove by tapping lightly with a soft-face hammer.

27. Remove indicator equipment. Turn over shaft clamp plate installed upside-down in Step 18. Install the oil slinger (if used) with the clamp plate and tighten screws.

28. Check the drive shaft locknut for tightness and bend the ear of the lockwasher into the locknut slot.

T5CDL9L & T5CDL12L FASTENERS						
Ref. No.	Description	Part Number	Size (Inches)	SAE Grade	Torque (Ft-Lbs)	Torque (N-m)
8	Capscrew	655ED040	3/8" x 16 UNC x 1" lg.	5	30	(41)
18	Socket Hd Capscrew	75P6N	3/8" x 16 UNC x 3/4" lg.		38-41	(52-56)
22	Socket Hd Capscrew	75P57N	3/8" x 16 UNC x 1-1/2" lg.		38-41	(52-56)
54	Capscrew	655ED050	3/8" x 16 UNC x 1-1/4" lg.	5	30	(41)

NOTE: ( ) DENOTES ITEMS IN EXPLODED VIEW DRAWING ON PAGES 16 thru 25.

FIGURE 27 - TORQUE (FT-LBS) WITH DRY THREADS (NO LUBE)

⚠ CAUTION

Exercise care not to damage the seal lip as it passes over the shaft keyway.

Install the shaft oil seal in the gear end cover. Protect shaft keyway and oil the shaft to prevent damage to the seal on installation. Be sure the driver used is large enough to bear against the outer ring of the oil seal case. This prevents damage to the case and distortion of the seal lip.

29. Fill the gear case to the proper level with oil – refer to "Lubrication", page 13. Clean gear case breather filter and install; replace if necessary.
30. Cover all openings to prevent dirt from entering the blower during transporting or storage. If the blower is to be placed in storage refer to "Storage" , Section 1, page 1.

Oil the bearings and gears to prevent dry start and/or rusting during storage.

Gardner Denver

WARRANTY

GARDNER DENVER®

CDL SERIES CYCLOBLOWERS®

GENERAL PROVISIONS AND LIMITATIONS

Gardner Denver (the "Company") warrants to each original retail purchaser ("Purchaser") of its new products from the Company or its authorized distributor that such products are, at the time of delivery to the Purchaser, made with good material and workmanship. No warranty is made with respect to:

1. Any product which has been repaired or altered in such a way, in the Company's judgment, as to affect the product adversely.
2. Any product which has, in the Company's judgment been subject to negligence, accident, improper storage, or improper installation or application.
3. Any product which has not been operated or maintained in accordance with normal practice and with the recommendations of the Company.
4. Components or accessories manufactured, warranted and serviced by others.
5. Any reconditioned or prior owned product.

Claims for items described in (4) above should be submitted directly to the manufacturer.

WARRANTY PERIOD

The Company's obligation under this warranty is limited to repairing or, at its option, replacing, during normal business hours at an authorized service facility of the Company, any part which in its judgment proved not to be as warranted within the applicable Warranty Period as follows.

BARE BLOWERS

Basic bare blowers, consisting of all parts within, are warranted for 12 months from date of initial use or 18 months from date of shipment to the first purchaser, whichever occurs first.

Any disassembly or partial disassembly of the blower, or failure to return the"unopened" blower per Company instructions, will be cause for denial of warranty.

OTHER COMPONENTS

All other components are warranted for 12 months from date of initial use or 18 months from date of shipment to first purchaser, whichever comes first.

LABOR TRANSPORTATION AND INSPECTION

The Company will provide labor, by Company representative or authorized service personnel, for repair or replacement of any product or part thereof which in the Company's judgment is proved not to be as warranted. Labor shall be limited to the amount specified in the Company's labor rate schedule.

Labor costs in excess of the Company rate schedule amounts or labor provided by unauthorized service personnel is not provided for by this warranty.

All costs of transportation of product, labor or parts claimed not to be as warranted and, of repaired or replacement parts to or from such service facilities shall be borne by the Purchaser. The Company may require the return of any part claimed not to be as warranted to one of its facilities as designated by Company, transportation prepaid by Purchaser, to establish a claim under this warranty.

Replacement parts provided under the terms of the warranty are warranted for the remainder of the Warranty Period of the product upon which installed to the same extent as if such parts were original components thereof.

DISCLAIMER

THE FOREGOING WARRANTY IS EXCLUSIVE AND IT IS EXPRESSLY AGREED THAT, EXCEPT AS TO TITLE, THE COMPANY MAKES NO OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY.

THE REMEDY PROVIDED UNDER THIS WARRANTY SHALL BE THE SOLE, EXCLUSIVE AND ONLY REMEDY AVAILABLE TO PURCHASER AND IN NO CASE SHALL THE COMPANY BE SUBJECT TO ANY OTHER OBLIGATIONS OR LIABILITIES. UNDER NO CIRCUMSTANCES SHALL THE COMPANY BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, LOSSES OR DELAYS HOWSOEVER CAUSED.

No statement, representation, agreement, or understanding, oral or written, made by any agent, distributor, representative, or employee of the Company which is not contained in this Warranty will be binding upon the Company unless made in writing and executed by an officer of the Company.

This warranty shall not be effective as to any claim which is not presented within 30 days after the date upon which the product is claimed not to have been as warranted. Any action for breach of this warranty must be commenced within one year after the date upon which the cause of action occurred.

Any adjustment made pursuant to this warranty shall not be construed as an admission by the Company that any product was not as warranted.

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